


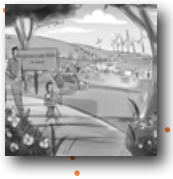
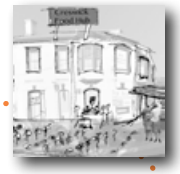




Visions of Resilience

Design-led Transformation for Climate Extremes

Project Team

Che Biggs - VEIL
Chris Ryan - VEIL
Jessica Bird - VEIL
Michael Trudgeon - VEIL
Rob Roggema - Wageningen University

With specialist contributions from:
Roger Jones - Victoria University
John Martin - La Trobe University
John Wiseman - The University of Melbourne
Martin Brennan - ICLEI
Ammon Beyerle - The University of Melbourne
Philippa Abbott - A&D Projects

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Appendices are available via the online pdf version here:

www.ecoinnovationlab.com/project/visions-of-resilience/

For enquiries about this report contact
Che Biggs at VEIL: cbiggs@unimelb.edu.au

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EXECUTIVE SUMMARY

Climate change is re-writing the record book on weather extremes and communities face the brunt of these impacts. In the wake of recent extreme events agencies at all levels of government are turning to concepts like resilience to emphasise preventive disaster management. But resilience is a novel concept for Australia's emergency management institutions and translating it into practice will be challenging. Significant innovation is required to enable this process. The way disaster risks are currently conceived, how adaptation is planned and which voices and views shape the planning process must change.

This report puts community stakeholders at the heart of building resilience to climate extremes. It demonstrates why and how local perspectives and values must have a seat at the table when disaster mitigation strategies are conceived and designed. Methods to develop community-led strategies and identify local barriers to change, like the one developed in this project, are essential to this process.

Emergency management practitioners surveyed and interviewed for this report acknowledge climate change will cause major and irreversible change at the community level over the next two decades. However, these people also believe communities and emergency management agencies are failing to grasp the scale and urgency of the issue. Familiar institutions are not helping. Emergency management practices are overly geared to disaster response at the expense of disaster prevention. Planning for extreme events is reliant on predictive methods and unrealistic certainty, and local stakeholders are not effectively integrated into the design of mitigation strategies. Furthermore, at the organisational level, long-term decisions don't reflect the severity of climate change risks.

Building local resilience to climate extremes requires new tools, thinking and practices to address shared risks and guide adaptation planning under extreme uncertainty. We don't have the ability to predict future extremes. At best, our climate models and natural disaster experts can provide only a vague idea of how severe local weather events will become. Preparing for this future is made more challenging by poor clarity over what commensurate climate resilience looks like. Every community faces its own unique risks and its own opportunities for change.

This report outlines a tested process to help agencies and communities engage creatively with the issue of extreme climate risks. Results show communities bring essential perspectives of local vulnerabilities and potential impacts to the design table. The report case studies emphasise that building local resilience will depend on how much communities own the mitigation and adaptation strategies that affect them.

The primary lesson is that building resilience to climate extremes should be seen as a social innovation process. Findings show communities confronted with extreme climate scenarios can develop highly sophisticated proposals for building local resilience. Many involved radical changes – indicating communities can and will re-prioritise valued assets when allowed to explore and comprehend the scale of climate risks.

Critically, proposals involving compromise and radical change were not designed exclusively to manage risks. They added services, skills and new assets that were aligned to community identities and aspirations. These lessons suggest emergency management and other relevant agencies would benefit by framing disaster mitigation as community development, with risk management an integral but secondary outcome. Climate mitigation strategies driven solely by risk management considerations are unlikely to gain widespread buy-in.

This report presents results of a two-year research project exploring community-based visions of climate resilience and barriers to change. Visions of Resilience was led by the Victorian Eco-Innovation Lab (VEIL) and funded by the Australian Government through the Victorian Department of Justice (Natural Disaster Resilience Grant Scheme).

Results are drawn from two Victorian case studies in Anglesea and Creswick and interviews with emergency management and climate change adaptation practitioners. The case studies tested a participatory design-led process where communities explored local vulnerabilities to climate extremes and proposed desirable mechanisms to build local resilience. Workshops with community and agency stakeholders then explored pathways and barriers to create these future 'visions of resilience'. A workshop manual outlining the processes used can be found at: www.ecoinnovationlab.com/project/visions-of-resilience/

Devolution of control is key to local resilience

For communities threatened by climate extremes, building resilience involves gaining influence over local assets and over decisions about what is lost, protected and changed. Proposals for building resilience developed in this project show no evidence community see government agencies as primary problem solvers. Most proposals depict a shift in power from state to local government and local government to community agents of change. Five core strategies were found to underpin all community propositions for building resilience. Each reflects some form of devolution in control and/or an increase in local agency. The five strategies involved:

- **Harnessing and re-configuring under-used assets to diversify critical functions (like energy, water, food and transport provision).** Community proposals included using flooded mines to cool public buildings and linking dams, storm water and household rain water collection into a networked 'water-bank'.
- **Developing new partnerships to improve collective decision-making and increase transfer of disaster mitigation techniques and survival experiences.** Examples included intergenerational mentoring projects, oral-history archives, men's shed style home retrofitting businesses, and inter-community, post-disaster, knowledge-sharing programs.
- **Strengthening social cohesion to improve access to local assets, harness local strengths and unite people around a common cause.** Examples included festivals, public-led arts projects, training institutes and the formation of local commons.
- **Increasing influence over key functions outside community control.** Proposals involved augmenting centralised infrastructure with local market gardens, turbine-connected hill-top water storage and farm-to-plate type business models.
- **Creating new institutions for sharing ownership and governance of critical assets.** These took the form of community owned utilities, food hubs, multi purpose respite centres and machinery share schemes.

Critical barriers to building local resilience

Close to 40 common barriers were found to pose a risk to community-led resilience building. Three problem issues were found to play a particularly influential role. To enable community-led change, these issues must be addressed.

Institutions that bridge communities and emergency management agencies are rare or ineffectual. There is a vast gap in how emergency management and community stakeholders see each other. A few champions aside, communities aren't familiar with agency planning processes and don't have experience lobbying for agency support; they don't know where to turn. For agencies, meaningful partnership with local stakeholders is limited by a hierarchical expert-driven culture. In this environment, disaster risk mitigation is narrowed to a top-down process where community is a passive recipient of hazard information. In addition to overcoming this divide, bridging institutions are undermined by mistrust that 'community-resilience' is a Trojan horse allowing state-level agencies to shed responsibility onto regional and local government.

Many community-led concepts to build resilience don't fit traditional governance or business model templates. Communities feel solutions will involve concepts like town scale utilities, open source platforms for collecting and sharing environmental data and hybrid water and energy grids. But these don't match traditional subsidised or competitive private enterprise service models. Furthermore, many community proposed initiatives also relied on some form of collaborative business or governance model. These exist but are a long way from being part of the emergency mitigation tool kit.

Building climate resilience from the bottom-up asks all stakeholders to question familiar roles. This includes agencies acknowledging they often don't have all the answers or have made mistakes. This means losing position and status as experts in the process. It also requires agencies to play new roles – as facilitators or development partners when working at the local level. Communities will also be challenged - particularly by having to take on new responsibilities and in having to accept the reasonable capacity limits of local and state agencies.

Communities have a valuable role to play in natural disaster management but don't have a seat at the planning table. Building resilience to climate extremes will take all our ingenuity and persistence. It requires bringing communities and agencies together in creative partnerships to envisage how climate resilient communities can work and foster the social innovations to make it happen.

This report emphasises that building resilience can't be a defensive process. Preparing for future climate extremes demands radical pro-active change - championed by the people it will affect. New engagement methods and design processes like the one developed in this report will be critical.

Recommendations

State and local government can do much to foster local resilience to climate extremes. This research suggests specific actions suitable for both levels of government - including the following:

1. Use scenarios of future climate extremes to periodically review state and local government disaster preparedness.

2. Develop an open online collection of community-driven resilience building initiatives and support tools – focusing on business and governance models.

3. Update existing emergency management guideline documents to explain the deficiencies of probabilistic risk estimates of future weather extremes.

4. Increase financial and material support for community development programs that address local vulnerabilities to extreme weather.

5. Support action-oriented research on how community-led social innovation can improve local resilience.

6. Always define resilience when using the term in public documents and adopt an interpretation of resilience that prioritises adaptation over resistance.

7. Experiment with the method used in this project when designing local and regional scale emergency or development planning schemes.

Section 1

INTRODUCTION

INTRODUCTION

Whether you live in deep suburbia or in an idyllic coastal town, chances are you have experienced an extreme weather event. You have probably been dizzy in a baking heatwave, skipped a shower in a drought, and if not seen a bushfire, then at least breathed in the wind-blown smoke from one. Living with these hazards is almost part of the national psyche. So do future climate projections of more droughts and floods sound like more of the same? They should. People aren't good at imagining what they haven't experienced and are worse at responding to threats that don't seem real. This is a major problem because climate change is re-writing the record book on weather extremes.

Australian governments at all levels have responded to recent weather extremes by emphasising resilience as a goal in emergency management policy. This includes advocating for more decentralised and adaptive approaches to natural disaster management and more focus on vulnerabilities at the 'local' or community level – where most natural disaster impacts manifest. These reforms are widely seen as positive and necessary but translating them into practice is in its infancy. We urgently need to turn the rhetoric on resilience into action on the ground. Communities are already feeling the brunt of climate extremes.

About the project

This report presents findings from a two-year research project run by the Victorian Eco-Innovation Lab at the University of Melbourne. The project was funded by the Australian Government through the National Disaster Resilience Grants Scheme. The work targets deficiencies in the way natural disaster management practices mitigate impacts from climate extremes and transfers concepts like resilience into tangible strategies.

Climate change is an amplifier of natural disaster risk

Future planners and emergency managers may well look back enviably at current risk conditions. A growing body of research across finance and insurance [1, 2], global development [3], and national security [4] describes a near future with a radically different risk landscape to the one we now operate in. Today's extreme events are shaping to be tomorrow's norms.

Climate change impact research has moved well beyond questions of 'if and where' to focus on unpicking 'how quickly and how much'. The picture from this research shows whole-scale shifts in environmental conditions are occurring at many spatial scales. It only takes small changes in global averages to transform climate conditions at the regional scale. Regional shifts are again amplified at the 'local' scale. For communities in towns and suburbs this means radical changes to the weather extremes they are accustomed to. The 0.8^{0}C increase in global temperature recorded so far is already driving the formation of weather events that lie outside the bounds of local experience in many parts of the globe. Since the 1960's there has been a ten-fold increase in areas experiencing 1-in-100 year heat events (with an assumed 1% annual probability) [5]. The 2009 Victorian heatwave that preceded Black Saturday and the Russian heatwaves prior to the 2010 wildfires were at this scale. With decades of additional warming 'locked-in', the spread and intensification of heatwaves will continue – possibly beyond our comprehension. Recent climate modelling projects that in a few decades, small areas (3%) of the planet may even feel 1-in-4,500 year magnitude heat events [6]. These lie far outside historical experience; we have no comparisons.

The amplification of heatwaves is just one symptom of climate change. Major shifts will occur in most areas of the environment, and a growing body of recorded data shows changes are well underway. A brief survey of peer-reviewed science indicates southern Australia will see major changes in weather patterns including seasonal shifts, greater storm intensity, more intense drought and more days of extreme fire-risk. In the oceans, we are already seeing other symptoms such

What do we mean by resilience?

In this report we adopt a general framing of resilience that is not specific to a particular shock or disturbance.

Resilience is the measure of disruption a town or local community can absorb without losing its desired identity or critical functions. Building resilience therefore increases functional security and the ability to retain identity.

as greater acidity and temperature increases affecting the health and distribution of some species [7-10]. With greenhouse gas emissions on track to drive 4-6°C of global warming this century, far more catastrophic global-scale changes are also possible. The loss of major ice sheets, growth of oceanic 'dead zones' and the disappearance of vast tropical ecosystems are realistic possibilities [11-13]. Each of these environmental hazards will bring their own suite of knock-on consequences. A range of likely examples include increases in the spread of some diseases, negative affects on life expectancy and psychological stress [14], reductions in power station and distribution efficiency [15], even falls in the protein content of certain crops [16].

Emergency managers face a future where many major disasters won't have a clear origin or cause, only catalysts.

The diversity and scale of climate change impacts have prompted some experts to call for a new approach to thinking about future risks [17]. Emergency managers face a future where major disasters won't always have a clear origin or cause, just a growing set of possible catalysts. Grasping this emerging risk environment at the policy and strategy level is more important than identifying specific future hazards. It's about seeing the wood from the trees. In its Global Risks 2014 report [3], the World Economic Forum notes climate change is one of multiple drivers of 'systemic risk'. At this level, risks are capable of causing "...breakdowns in an entire system, as opposed to breakdowns in individual parts or components…" [18]. Systemic risks are growing because the links between economic, political, technical and environmental systems are increasingly tight. This 'tight coupling' means the buffers, redundancies and fail-safe mechanisms normally able to mitigate volatility are easily overwhelmed [19]. In this hazard 'echo-chamber' [17], even small changes can lead to an amplifying cascade of knock-on impacts. The effects of extreme weather can therefore propagate well beyond their point of origin and increase the chance of unexpected and synergistic impacts. These snowball-to-avalanche possibilities are most likely where systems are already stressed [20]. Because climate change is a primer for systemic failure, climate-proofing cities, towns and suburbs must take into account the possibility of synergistic hazards like resource security, investment dynamics or political stability. They are part of the same risk landscape. A critical question then is how should emergency management evolve when the stakes are higher and the threats harder to pre-empt?

What do we mean by emergency management?

When emergency management is mentioned in this report, it refers primarily to the set of practices and organisations concerned with natural disaster management. However, because the issues and lessons explored are more broadly applicable and relate to people and agencies with very different roles and titles we use the umbrella term of emergency management (EM).

Three innovation challenges for emergency management

This report focuses on three areas where emergency management must evolve to match the risk landscape now emerging.

Challenge 1 – Weaning emergency management off prediction based planning

Widely used methods for assessing risk and disaster probability rely on questionable assumptions and subjective value-based decisions [22]. They can pose a liability in a world of climate extremes.

In particular, risk management practices that rely on narrow, quantified estimates of risk undermine preparation for climate extremes. This 'predict-then-act' paradigm [23] is particularly evident in insurance, civil engineering and spatial planning where risk management relies on definitive frequency and probability estimates of hazard events [24]. These practices work well for frequent events with familiar impacts. However, they can undermine mitigation by giving decision makers artificial certainty about the scale and likelihood of future events.

"Subjectivity permeates low probability high consequence risk assessments because they rely on judgements at every step of the process." [21]

Probability estimates of low frequency, high impact weather events can be misleading. Partly, this is because estimates are extrapolated from historical records and since extreme events are rare, there's limited data to indicate natural frequency [25]. However, data availability masks bigger issues about to how people think about, manipulate and interpret data to define (and downplay) risk.

A common example involves specialists creating climate and statistical models that deliver false certainty about future weather events [26]. For example, flood and drought models typically assume the frequency of extreme events follow clear patterns. This approach can work at a year or decade scale, but often does not reflect variation over longer periods [27]. Underlying climate patterns are not fixed; they change naturally, sometimes dramatically. Global warming is also re-coding the climate systems we have based our methods around [28, 29]. Designing and interpreting climate models as if clear long-term patterns exist makes it easier to calculate clear probabilities for floods and drought events. It helps decision-makers calculate risks but it does not necessarily make them accurate.

Artificial clarity is also prioritised over risk transparency in subtler ways. For example, people tend to take definitive estimates of risk more seriously than descriptive accounts or figures with large uncertainty values. Psychological studies show people consistently down-play the likelihood and seriousness of events we haven't experienced [30]. People also commonly ignore risk factors they don't understand or agree with [31]. These behaviours simplify decision making but have major implications for risk mitigation. For example, in some global climate models, known (and potentially catastrophic) phenomena were simply left out because they were poorly understood [32]. Factoring in these knowledge gaps means models produce wider uncertainty values (and include more extreme events). This type of risk 'filtering' helps reduce decision-making uncertainty [32] but the end results underestimate potential hazards. Critically, it's the high-impact possibilities that are ignored. Organisations basing adaptation strategies on 'most-likely' climate scenarios filter risks in the same way.

"…there are no institutional processes for designing with the uncertainty caused by climate change in mind."

Council officer, Melbourne metropolitan area

In institutional environments where risk uncertainty creates problems for decision-makers, disaster response will likely trump prevention. When risks are downplayed to reduce uncertainty, it makes sense that mitigation gets overpriced and underfunded. It is therefore no surprise that a recent study by Deloitte Access Economics found resources spent on disaster recovery eclipse mitigation by 10:1 in Australia [33].

An important starting point to address this mitigation deficit is transparency. Practitioners need to know the limits of probability evaluation for extreme weather events. It is also important to recognise many of these limits can't be solved by better disaster prediction. The knock-on impacts from climate change are too complex and context specific. At best, improved data collection and

modelling capabilities will allow us to explore possible future risks with more clarity but not predict extreme event probability in advance. New practices are needed to help natural disaster managers explore and plan for highly uncertain and catastrophic hazards.

Scenario-based methods are an example of the practices used to help organisations plan for high risk and uncertain futures. They have been developed in response to the limits of predictive models and use quantitative and qualitative evidence to identify multiple future operating (or hazard) conditions. Scenarios are used as a conceptual shock-test for organisations - helping identify critical unknowns, identify high risk possibilities and evaluate planning and investment decisions.

In Australia scenario methods are rarely applied to disaster resilience at the local government or community level. Where they are used, exploratory scenarios are often not respected as decision-making tools. Our planning institutions struggle to fit scenario methods into existing prediction and evidence-based decision making practices [39]. However, internationally, scenarios are increasingly used to guide decisions and investment where extreme events pose major risks. Recent and on-going applications include business contingency planning [34], defence and security [35], food security assessment [36], insurance risk assessment [1] and disaster preparedness [38].

Challenge 2 – Pursuing resilience-as-adaptation over resilience-as-strength

Resilience is a popular term in policy and planning. But it is a contested concept often vaguely defined. How resilience is 'framed' and which frame becomes institutionalised will play a big role in shaping natural disaster mitigation for decades.

Two differing perspectives on resilience are often used in EM. One prioritises strength, resistance and rapid return to pre-disturbance conditions. The other emphasises the maintenance of flexibility and the capacity to adapt in a desired direction - prompted by actual or expected disturbances [40].

Traditional EM approaches tends to follow the 'strengthen, resist and bounce-back' approach. For example, in Victoria's Critical Infrastructure Resilience Interim Strategy [41], the emphasis is on urban hardware being resistant, reliable and involving redundancies. Management's primary role is building the capacity to respond and recover from disruption. The Insurance Council of Australia [42] takes a similar approach in their description of community resilience. They emphasise a capacity to respond and mitigate disasters through household preparation and insurance. These principles are important but only reflect aspects of resilience geared to protecting existing institutions, organisations or assets. This framing of resilience is best applied in a stable risk environment. It puts little emphasis on evaluating how appropriate systems at risk are or on how to build flexibility and enable change.

In an unpredictable hazard environment, a community's ability to resist and bounce-back may mask or exacerbate longer-term problems. Strengthening resistance can mean resources are wasted protecting assets that were poorly conceived, located and designed or that will inevitably fail. A focus on 'bounce-back' can also mean resources are spent after a disaster to recreate the vulnerabilities that existed before. In worse case scenarios, the resources spent on protection and recovery undermines resilience - leaving communities without the means and capacity to change.

An alternative framing of resilience focuses on retaining critical functions and identity in the face of shocks through adaptation. To explain, we'll use a community scenario. Any community needs critical functions to exist; the ability to access water, energy and food and ways to exchange goods and services for example. But it does not necessarily need these functions to be delivered in a particular way. Houses can be heated using bar-heaters powered by vast electrical distribution systems or by the particular placement of windows, thermal mass and insulation. It's the function - heating - that matters most. Of course, a community is not just a collection of functions. It has an identity (or identities) – shaped by its collective values and aspirations and reflected in what people do and expect of each other. These values and aspirations might also be expressed in different ways. For example, activities that reflect a connection to the natural environment or express a strong volunteer ethic can take many forms.

A resilience-as-adaptation approach focuses on protecting the critical elements of a town or region but emphasises change and flexibility in this process. It reduces focus on less essential factors like habits of behaviour and built assets often imbued with everyday significance but whose protection can inhibit change. Building local resilience must be grounded in community values and aspirations. An emphasis on retaining functions and identity recognises this.

Pursuing a resilience-as-adaptation approach poses a number of challenges. It requires projects and programs to be highly sensitive to local context, including at the level of community cultures and shared-meaning. Strategies and programs to build local resilience must therefore avoid the types of centralised template solutions often rolled-out by government agencies. Our preferred approach also relies on identifying and understanding the complex dynamics among climate and non-climate risk factors at a suburb, town and regional level. Without tangible knowledge of the risks facing towns and communities from climate extremes, we can't determine what subtle changes might mitigate those risks. As the retainers of this information, communities will need to play a leading role in an adaptation-driven approach to climate resilience.

Challenge 3 – Embedding disaster mitigation in everyday community practices

Communities have a central role in building local resilience but are passive 'bit players' in natural disaster management. Despite agency recognition that engaged communities are important [21, 43-45] EM structures and practices still reflect an 'experts-lead, citizens-follow' model. In COAG's National Strategy for Disaster Resilience, for example, EM agencies are advised to support local resilience by providing "…community with the information needed to prepare for and mitigate the impact of natural disasters" [46]. Decades of research on information-led behaviour change suggest this will be of limited value. The roll-out of Township Protection Plans in Victoria demonstrates a similar approach. Council, SES and CFA officers interviewed for this project criticised the "cookie-cutter" process for breaking fundamental principles of engagement, including not giving locals a meaningful say in designing plans to match their environment. It is another example of a top-down template approach to disaster mitigation. It shows little sensitivity to context or the attributes that make up an engaged, fire-ready community.

Community dynamics are as central to local disaster mitigation as EM expertise. Factors such as social connectedness and cohesion, knowledge of local hazards and vulnerabilities, access to resources and collective leadership will be vital in a changing risk landscape [47-49]. Because these attributes are also essential in day-to-day community functions, they provide an existing foundation on which climate resilience can be built.

What do we mean by community?

For this report we see communities as groups "…who live in a similar region; those who have similar characteristics and relate to each other as a community; and those who come together in response to an issue…" [47]. By a 'local community', we mean those living in the same place.

Building on the strengths within communities will require emergency management agencies to play a facilitation role and support people-led or 'co-design' approaches to disaster mitigation. There is a strong shift in European public policy to adopt this type of approach across many areas of government. It is reaping benefits because innovative solutions are being developed, explored and tested by the people they affect most [50]. The same argument can be made for climate resilience. Research shows clear benefits where people and agencies see communities as 'innovators' rather than simply 'implementers' of disaster preparation and response [43]. Some of the most positive stories emerging from recent natural disasters and at-risk communities in Australia show people responding to risk and vulnerability in their own ways. Communities are cultivating new connections to learn from each other's disaster experiences, organising networks of support and experimenting

with new ways to deliver, access and pool resources [51, 52, 81]. However, some ‘success’ stories also describe a lack of EM agency tolerance for community innovation. They involve instances where communities have needed to break laws in order to address local vulnerabilities [81]. Most community-led examples are also focused on building disaster response capabilities. More work is needed to foster local disaster mitigation and preparation.

Communities need strong reasons to buy into and ensure new practices and thinking ‘sticks’. Therefore, strategies for addressing natural disaster risk must connect with what people value and aspire to. Paradoxically, EM agencies may be more effective at supporting pre-emptive mitigation by not focusing solely on risk and vulnerability. Having strong capabilities in areas like community development and small business innovation may be just as important. Ultimately, building climate resilience must make a positive contribution, add meaning or at the least, make sense to everyday life.

Climate change poses a rapidly evolving risk landscape. Effective adaptation will require changes to the way risks are assessed and addressed and which stakeholders play a leadership role in the adaptation process. This will challenge the way our communities, governance procedures and systems of resource provision work. Building the culture and institutions for a world of climate extremes presents the dual challenge of learning what desired climate resilience will look like while also identifying what barriers stand in the way. Neither can be addressed without exploration and experimentation. We need the tools to navigate both challenges in a collaborative way.

1.1 Project aims and rationale

The aim of this project was to understand what impedes or enables the development of local resilience for climate extremes. As discussed, our society has only a vague conception of future hazards and even less understanding about what a climate resilient community might be like. How then do we approach this problem? How do we identify the barriers to a future we don't know, using processes we don't have?

Our answer was to develop an intervention process in two communities, ask community participants to envision resilient futures and ask stakeholders what was needed to create those futures. We looked for barriers every step of the way. This strategy was informed by the logic that to identify the challenges communities face in building resilience to climate extremes, we must first understand:

- what communities value and where they want to prioritise resilience building
- what will be affected by weather extremes, and what matters most to those affected
- what adaptive changes communities see as desirable and undesirable
- how desired changes could occur.

Only when these questions have been answered can we ask - what challenges will desired changes face?

The objectives of this work were to:

1. Develop a participatory scenario-based process for identifying positive resilient futures.
2. Apply the process in two case study towns with their communities and broader stakeholders to explore and understand:
    - opportunities and factors necessary to build local resilience to climate extremes
    - barriers (particularly institutional barriers) to local resilience building
    - potential mechanisms (including policy recommendations) to overcome barriers and help build local resilience to climate extremes.
3. Verify results with literature reviews, a survey and interviews.
4. Produce a 'how-to' guide to enable others to replicate and adapt the process.

Section 2

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

The research process combined a mix of traditional and design-led research methods comprising four elements:

- a review of literature
- interviews with community stakeholders and climate change adaptation and emergency management practitioners in local and state government
- a survey of climate change adaptation and emergency management practitioners
- development and testing of a scenario-based workshop process (the design-led intervention) in two case study towns.

Review of literature

The review included a study of material in the fields of climate change adaptation, emergency management and risk management to identify barriers to local resilience. The review primarily explored literature from Australia with a focus on identifying barriers affecting local government and community. Research from the UK, Canada, New Zealand and the US was also analysed for comparison and verification. Results were summarised into a systems of influence diagram (Appendix 1) to understand the relationships and connections between critical barriers. The diagram was used to help identify critical barriers and potential leverage points for change to explore in interviews and workshops. The review of literature was also conducted to identify key ingredients and principles for resilience relevant to local community contexts.

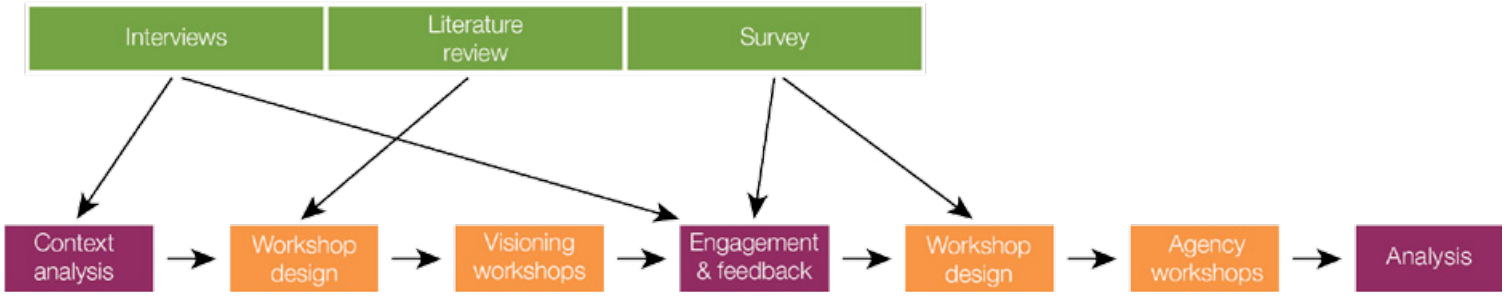
Interviews

Semi-structured interviews were conducted with 13 climate change adaptation and emergency management practitioners in Victorian local and state government agencies (Appendix 2). Interviewees were identified through professional networks (including referrals). Questions explored institutional challenges to planning for weather extremes.

Survey

An anonymous online survey captured responses from 50 practitioners involved in the emergency and risk management, climate change adaptation or planning fields in Australia. The majority (83%) were Victorian. The survey was emailed to organisations listed on the Emergency Management Manual Victoria contact directory, through the Victorian Greenhouse Action alliances and disseminated via the LinkedIn Climate Adaptation Group. Questions explored individuals' perceptions of climate change, the future risk environment and agency preparedness (see page 22 and appendix 3).

Results from the previous three elements were used to inform the design of the scenario-based workshop process (section 2.1), confirm assumptions guiding the intervention, and help analyse results.



2.1 Design-led intervention

The main component of the research involved testing a design workshop process in two Victorian towns. Design-led interventions are particularly useful as a research tool when exploring complex problems where no clear solutions exist, and for approaching them from multiple angles. Done well, they can inhibit normal practices, force new thinking and expose alternative view-points and assumptions - revealing insights that are difficult to detect simply by asking questions or observing everyday behaviour [53].

The workshops had a dual purpose: to test a prototype method that could help local communities develop resilience in responses to climate extremes; and to act as a provocative intervention, helping the research team identify barriers, challenges and opportunities relevant to building natural disaster resilience. The workshop methodology was influenced by VEIL's Eco-Acupuncture program involving design-led enquiry, scenarios and future visioning processes. Input from designers in the project team was also crucial. The workshops combined elements of scenario planning, vulnerability assessment, future-visioning and back-casting processes [54, 55].

For each case study town, the process revolved around a set of two workshops conducted 9-12 months apart. The first of these workshops enabled community participants to:

- explore the implications of a worst-case future climate scenario set in the year 2037
- identify a range of adaptation options
- propose desired visions of the future.

The second workshop explored barriers to a sub-set of visions proposed in the first workshop. It helped uncover many of the institutional factors likely to influence local resilience building.

After presenting the two case study towns (Anglesea and Creswick) we summarise the six major stages in the development and application of the workshop process. A full description of the processes can be downloaded as a stand-alone manual from ecoinnovationlab.com/project/visions-of-resilience/

Why – scenarios for 2037?

From VEIL's experience running future visioning processes, a 25-year time horizon is ideal for exploring 'what-if' future scenarios. 25 years is distant enough from the present that organisational decision-makers can put aside current responsibilities. But it is also close enough that any dominant technologies are probably known today. Furthermore, climate modelling indicates emissions reductions will not make a significant difference to environmental conditions until around 2040; at which point the climate conditions linked to alternative emissions trajectories begin to diverge [6]. This last factor reduced the complexity of scenario creation. It meant there was no need to take emissions scenarios into account when exploring climate conditions.

Case studies

Anglesea and Creswick were selected from 12 potential sites in Victoria. There were four selection criteria.

1. Exposure: Sites are susceptible to multiple climate related events.
2. Complexity: A scale large and complex enough to involve multiple economic activities, social groups, strengths and weaknesses but also small enough to enable the researchers to understand the primary dynamics in each town.
3. Partnership: Shire council interest and a willingness to participate in the process.
4. Contrast: Comparatively different social, economic and environmental conditions.

Anglesea

Anglesea lies at the eastern end of Victoria's iconic Great Ocean Road (GOR), 110 km south-west of Melbourne. Located in the Surf Coast Shire, it has a permanent population of around 2,500 and a peak summer population that grows to over 16,000. The town community self-identifies as a coastal village and has a strong cultural connection to the ocean and surrounding bush. Key aspects of the town include its pristine beaches and bio-diverse heathland; a high non-resident population; an ageing demographic; higher than average level of volunteerism and a small open cut brown coal mine [56, 57]. Anglesea's economy is heavily reliant on seasonal income from tourism.

The town has a history of bushfires (it was badly affected in the 1983 Ash Wednesday fires) and is one of 52 Victorian towns considered highly vulnerable to bushfire. Fire risk is likely to increase in the future as climate conditions become dryer and hotter. Projected climatic shifts will also see longer heatwaves, exacerbate existing water shortages in the town and contribute to the risk of blackouts. Higher intensity rainfall events may also create problems with localised flooding along the lower stretches of Anglesea River (short duration flooding is already a problem). Sea level rise will also pose an erosion threat to multiple sections of the Great Ocean Road and key low-lying buildings and assets. Areas of Anglesea built on land that has been artificially raised are most at risk. By 2037, Anglesea may also confront the prospect that key climate tipping points will have been crossed – triggering irreversible loss of major ice-sheets at both poles (translating to many meters of sea level rise) and major changes in ocean and terrestrial ecosystems [58-60].

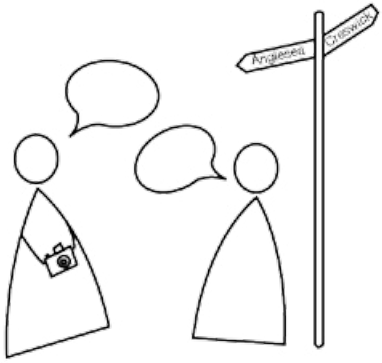
Victoria, Australia

Creswick

Creswick lies 130km north-east of Melbourne and 15 minutes from Ballarat, with a population of around 3,300. Located in Hepburn Shire, Creswick has a post-colonial history strongly linked to primary production. Gold mining, forestry and agriculture have played a major part in the town's economy at different stages. Key features of the town include its links to Federation, gold mining era heritage, natural amenity, a strong volunteer culture and a strong arts community. The University of Melbourne has a campus in Creswick [61-63].

Creswick is surrounded on three sides by bushland and plantation forests and has a history of flooding and bushfires. It was recently affected by three back-to-back flood events in late 2010 and early 2011 which severely affected parts of the town [64]. Creswick faces a warmer and drier future due to climate change, with fewer, more intense rainfall events. Likely implications include more intense droughts, more days of extreme heat and fire danger and a reduction in runoff to dams and creeks. High intensity rainfall events will also contribute to soil erosion and increase the impact and frequency of flash flooding along Creswick Creek [59, 65, 66].

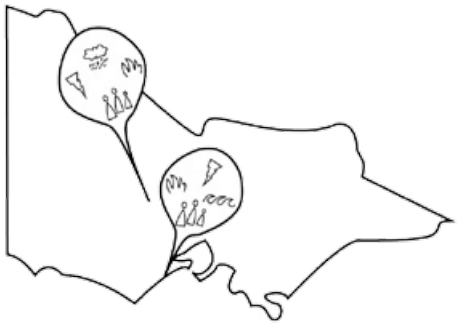
2.2 Process summary



1. Context analysis

- Engagement with shire councils
- Field research
- Local stakeholder interviews
- Quantitative data collection

This stage set up the conditions for the design workshops in Anglesea and Creswick and gathered the raw material that would be translated into future scenarios. Semi-structured interviews and conversations were conducted with Shire officers and community members to understand important local issues, people's concern about natural disasters, historical disaster events and shared values. Interviewees were identified through referral. Data was also gathered from historical literature, local newspapers and census material. Where possible, issues and anecdotes were cross-referenced. Climate conditions were derived from CSIRO modelling (MK3.5 outputs based on A1B and A1F1 emissions scenarios).



2. Scenario and workshop design

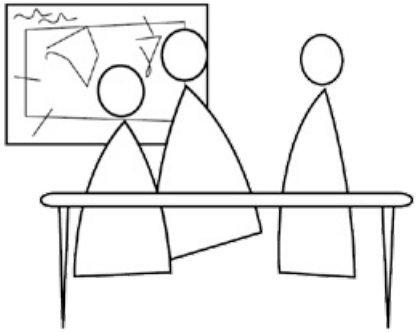
- Climate data analysis
- Future scenario creation
- Scenario verification
- Workshop process design

This stage involved designing the visioning workshop process and creating scenarios for Anglesea and Creswick. Both scenarios were developed by combining local knowledge obtained through interviews and plausible worst-case interpretations of climate change projections set in 2037. The scenarios were translated into three first-person perspectives of everyday life as seen by fictional residents (scenario stories). Using multiple narratives allowed different combinations and manifestations of extreme weather to be presented. The physical impacts of climate change were discussed with climate scientists to test their plausibility. Extrapolation of tertiary impacts described in the scenarios was based on analysis of climate change literature. Scenario stories for Creswick and Anglesea are in Appendices 4 and 5.

3. Participatory visioning workshops

- Identification of assets
- Identification of vulnerabilities
- Identification of adaptation options
- Exploration of positive futures

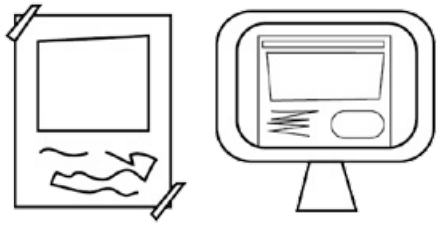
Two-day facilitated workshops were run in Anglesea and Creswick. Each involved 25-35 participants comprising local community members assisted by design facilitators. Design students from the University of Melbourne also participated in Creswick. Key stages saw participants identify local assets, explore vulnerabilities arising from the future climate scenarios and identify possible adaptation strategies. Concepts for adaptation were strongly guided by a series of resilience-based design principles (summarised on page 20). Each workshop resulted in more than 50 tangible propositions for building resilience.



4. Synthesising workshop outputs

- Analysis of workshop results
- Development of visions and narratives ('visions of resilience')
- Exploration and critique of visions with expert forum

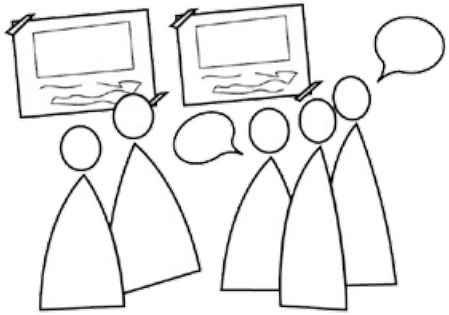
Outcomes from the visioning workshops (audio recordings, drawings, facilitator notes, maps and participant stories) were developed into a small set of representative future visions by the project team. This process identified common themes and synergies between community propositions and integrated these into coherent concepts and narratives of the future. Narratives described how the proposals built resilience in their local context and were augmented with a visual illustration prepared by professional designers. Outcomes were presented to a small forum of experts from emergency management, community development and climate change adaptation for comment.



5. Showcasing visions for feedback

- Display of visions online and on the street
- Collection of stakeholders responses

Visions of the future were posted around both towns. In some cases, posters were given QR codes to encourage broader audience engagement and direct people to websites where they were encouraged to leave comments. Visions were adapted to different media (a facebook page [facebook.com/Anglesea2037], website [anglesea2037.com] and public posters) to explore how alternative modes of communication would affect feedback. Results were collected through online comments and via conversations with members of both towns' communities (see Appendix 7).



6. Pathways and barriers workshops

- Exploration of pathways for change
- Identification of barriers to change
- Identification of leverage opportunities

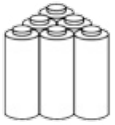
Workshops were held in Melbourne, Hepburn Shire and Surf Coast Shire to explore pathways and barriers to enabling the community visions. Participants numbered between 20 and 25 local and state government representatives with some community members also present (see Appendix 6). In each workshop participants explored ingredients and conditions needed for the visions to develop, identified barriers to these conditions and suggested leverage opportunities to overcome challenges.

2.3 Design principles for building local resilience

Resilience is a vaguely defined and often contested concept. This presents a challenge when working collaboratively with diverse groups. In research interviews, people's concept of resilience often described a community or agency's ability to respond and recover from natural hazards quickly. Many community residents also focused on purely psychological aspects of resilience (and also emphasised recovery). As the visioning workshops were focused on pre-emptive strategies to build resilience, the project team developed the following set of design principles and framing questions to guide workshop participants.

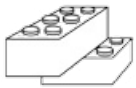
Diversity: Not everything is affected equally.

- Find different ways to meet the same outcome.
- Find solutions that aren't vulnerable to the same hazards.
- Focus on what is being delivered, not how. What function is essential?



Redundancy: Spare supply and functional capacity exists.

- Build-in or build-up buffers.
- Create 'just in case' options.
- Consider…if something runs out where else and how else can you get it?



Modularity: Autonomous building blocks that augment each other.

- Build capacity in incremental modules.
- Make sure module failure isn't contagious.
- Build networks that work across scales (individual, neighbourhood, regional).
- Find new ways to share (information and resources).

Rapid feedback: Consequences of actions and changes are detected and responded to quickly.

- Build awareness to new hazards – using different 'channels'.
- Consider…how long will it take to know what the consequences of an action are?
- Consider…who needs to talk to each other and how are they talking to each other?

Adaptive capacity: The ability to choose how to prepare and respond.

- Target the allocation of power and capacity where vulnerability exists
- Stress-test – having small failures can help identify weaknesses
- Consider…how can knowledge and skills be built and shared?
- Consider…what can help people's ability to organise?

Impact avoidance: Minimising exposure to hazards.

- Identify which places, functions and assets that are not exposed and ask why?
- Identify decisions that have led to exposure. Why were they taken?
- Consider…how could mitigating one risk act to exacerbate others?

These symbols will be used later to explain benefits of community visions in section 3.2.

 = Diversity

 = Redundancy

 = Modularity

 = Enhanced feedback

 = Adaptive capacity

 = Impact avoidance

Section 3

RESULTS AND ANALYSIS

RESULTS AND ANALYSIS

This section begins with a summary of perspectives from the field: selected results from a survey of emergency management and climate change adaptation practitioners. Subsequently, the results and analysis section is broken into four parts. The first – Site assessment, presents a synthesis of outcomes from the visioning workshops process run in Anglesea and Creswick. This is followed by a presentation of future visions for both towns in the second part. The third – Opportunities and barriers for climate resilience, presents a synthesis of outcomes from the pathways and barriers workshops. The final part – Process evaluation, looks at the combined workshop and engagement methods and identifies areas for improvement.

Perspectives from the field

The survey ran from August to November 2013 and collected responses from 48 emergency management (EM) and climate change adaptation (CCA) professionals. Respondents were primarily Victorian (83%, n=48) with half (54%) in State Government roles. Local government officers contributed 20% of responses. 72% of respondents defined themselves as having middle or senior rank.

Perceptions of future conditions

Almost all respondents (93%, n=44) believed climate change would increase the frequency and intensity of extreme events over the next 50 years. 68%, (n=41) felt climate change would have a major impact on environmental conditions within 50 years. Equal numbers also felt organisations would undergo significant change as a result of climate change within 20 years. 64% (n=41) felt communities would change significantly in the same period.

Despite the perception of risk, only 30% (n=44) agreed that agencies had a *…good understanding of the types of impacts society will face from climate change.*

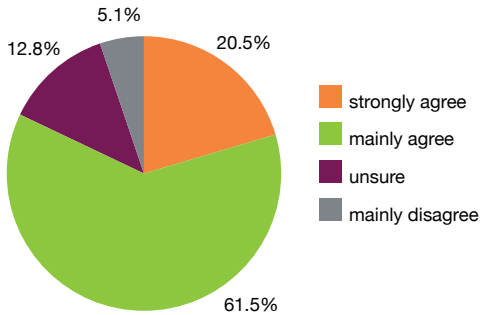
"[My] organisation is just starting to look at climate change adaptation and how this intersects with emergency management planning - behind the 8-ball basically"

Survey respondent, Local Government, Vic

Preparing for future climate extremes

83% (n=39) of respondents believed the level of preparedness and risk management within agencies did not reflect the scale of emerging risks posed by climate extremes (Fig. 1).

Results suggest agencies put a much stronger emphasis on response than mitigation. 85% (n=44) believed that more resources were allocated to response and recovery than to planning to avoid future disaster events. Similarly, a majority (70%, n=42) agreed with the statement that *…most organisations (responsible for emergency planning or climate change adaptation) emphasise short-term (5-15 year) asset protection strategies over alternatives that aim to avoid future impacts over a longer-term (30-50 years).* The most common reasons given by respondents were: the design of current regulatory requirements, a lack of resources, and the separation between planning and response functions within and across organisations. Respondents also noted that difficulty measuring the value of mitigation makes it challenging to assess and promote.



As a general rule, there is a disconnect between the level of risk posed by climate change and the level of preparedness and risk management within relevant agencies. (n=39)

Fig. 1

"Funding is often reactionary... so it's more feasible to spend money on response and recovery (events that have happened) than on planning (for events that haven't happened)"

Survey respondent, State Government, Vic

Responses also suggest the need for predictive certainty on future conditions undermines mitigation. 68% (n=44) of responses agreed that determining the frequency and size of future extreme weather

events with reasonable accuracy is *…a pre-requisite for adequate planning and preparation.*

Perceptions of community's role in building climate resilience

Practitioners believe community stakeholders have a valuable role in adaptation planning but don't see this reflected in the strategy of current agencies. 56% (n=41) of responses believed agencies saw community as best suited to playing passive roles in emergency management – implementing agency suggestions or providing comment on agency plans. Roughly half this number of respondents 24% (n=41) believed personally that this approach was community's most valuable role. A majority (73%, n=39) saw community's ideal role as providing active design input into local adaptation strategies.

"…community should play a direct role in developing policies that affect them however my organisations believe that to be somewhat of a risk"

Survey respondent, Local Government, Vic

Responses indicate limited resources, risk aversion, limited awareness and a culture of expectation are among a range of factors contributing to the lack of community involvement in natural disaster management.

64% (n=41) believed government agencies do not have the resources or capacity to cultivate meaningful community debate about climate impacts or adaptation.

"Most agencies are well equipped in ... their area of expertise/responsibility - and this is often not community development and engagement."

Survey respondent, Local Government, Vic

71% believed the general community is unaware of the risks posed by climate impacts. Roughly half (54%) saw community as unequipped to have a measured debate about climate impacts or adaptation options. Contributing factors included - community time constraints; the polarisation of climate change as an issue; low prioritisation for community engagement in state and local government, and poor scientific communication.

Interpreting results

The survey results should be treated with caution given the limited sample size. We cannot be statistically confident the opinions are representative of the thousands of people who work across the Victorian CCA and EM sectors.

However, the results show a fairly consistent picture of attitudes and concerns. The results also correspond strongly to arguments in academic and grey literature about the level of disaster mitigation failing to match expected climate impacts. In summary, many emergency management and climate change adaptation practitioners expect major and irreversible impacts in the next few decades but don't see agencies or community as prepared to engage meaningfully with what these changes will mean. The survey also backs up points made in Section 1 about mitigation being undermined by a reliance on prediction and quantification in CCA and EM. Results showed having an engaged and active community in disaster mitigation was seen as important but that agencies are also more comfortable if the public plays 'follower' on emergency management issues.

3.1 Site assessment

The exploration of resilient futures is based on an understanding of local assets and vulnerabilities. Community perspectives are important in determining which assets are valued and what impacts pose greatest concern. We explore both of these issues in the following pages.

Mapping assets

Assets are defined as attributes, objects or features critical to a town's identity or function. This framing is consistent with our framing of resilience as the capacity to retain critical functions and identity in the face of shocks and stress. Knowing what local assets exist can help determine what shapes the resilience of a town or region. For example, critical functions (like access routes or aquifers) that might assist a town adapt to future hazards. Identifying assets can also pin-point resources that need protection or that can be the basis for adaptation (such as key skills or people). Residents' perception of what is or is not an asset to a town can also show where stakeholders' priorities are aligned or in conflict. This knowledge can therefore help assess the potential significance of hazards to different parts of the community. Instances where community perceptions do not match an asset's importance (eg. water treatment) also help identify factors taken for granted and therefore potentially vulnerable to shocks.

The assets identified by Anglesea and Creswick participants are shown in Fig. 2 and Fig. 3 respectively. These diagrams present a synthesis of more than 100 assets collated into asset groups and categorised across six domains:

- culture and behaviour
- organisations
- natural environment and resources
- land use
- built environment and infrastructure
- economic activities.

Both diagrams show three types of information: what assets exist, who has influence over key asset groups, and how assets influence each other. The position of each asset relative to the centre of each diagram reflects whether the local community (inner circle), or the relevant shire council or other external agents (outer circle) have greater control. The arrows linking assets show whether a change in one asset will affect another and the direction of influence.

Anglesea

The town's culture, critical infrastructure and natural environment play a key role in defining Anglesea's identity and functions, as seen in Fig. 2. In particular, the coastline and heathland are key drivers of tourist-related income and Anglesea's population of temporary residents. Most of these natural assets lie outside the direct influence of the local community but are essential to its tourism-based economy and in turn the retention of essential services. The town's natural assets are also intrinsically linked to the community's embrace of the outdoor environment; for example its sporting and conservation groups.

Reading the asset diagrams

Fig. 2 and Fig. 3 are simplified influence diagrams. By following the direction and pathways of influence from one asset to another, we can identify which assets are isolated and which sit within a strong set of relationships. This understanding can help identify which assets may be closer to the root-cause of an issue and a starting point to lever wider change. The figures depict complex systems and capture the detailed local knowledge and perspectives of workshop participants. However, they are not complete system diagrams. Not all factors and causal loops are shown.

If the natural environment defines much of Anglesea's social and economic character, key infrastructure assets enable it to function. In particular, the Great Ocean Road (GOR) is vital for the tourist economy and the supply of food and fuel. Electricity and water distribution infrastructure are essential for both permanent and tourist populations. The supply and functioning of all critical infrastructure depends on factors outside community control.

The most important assets under community influence are the town's social groups, its welcoming attitude and culture of volunteering, and the depth of nature based education skills.

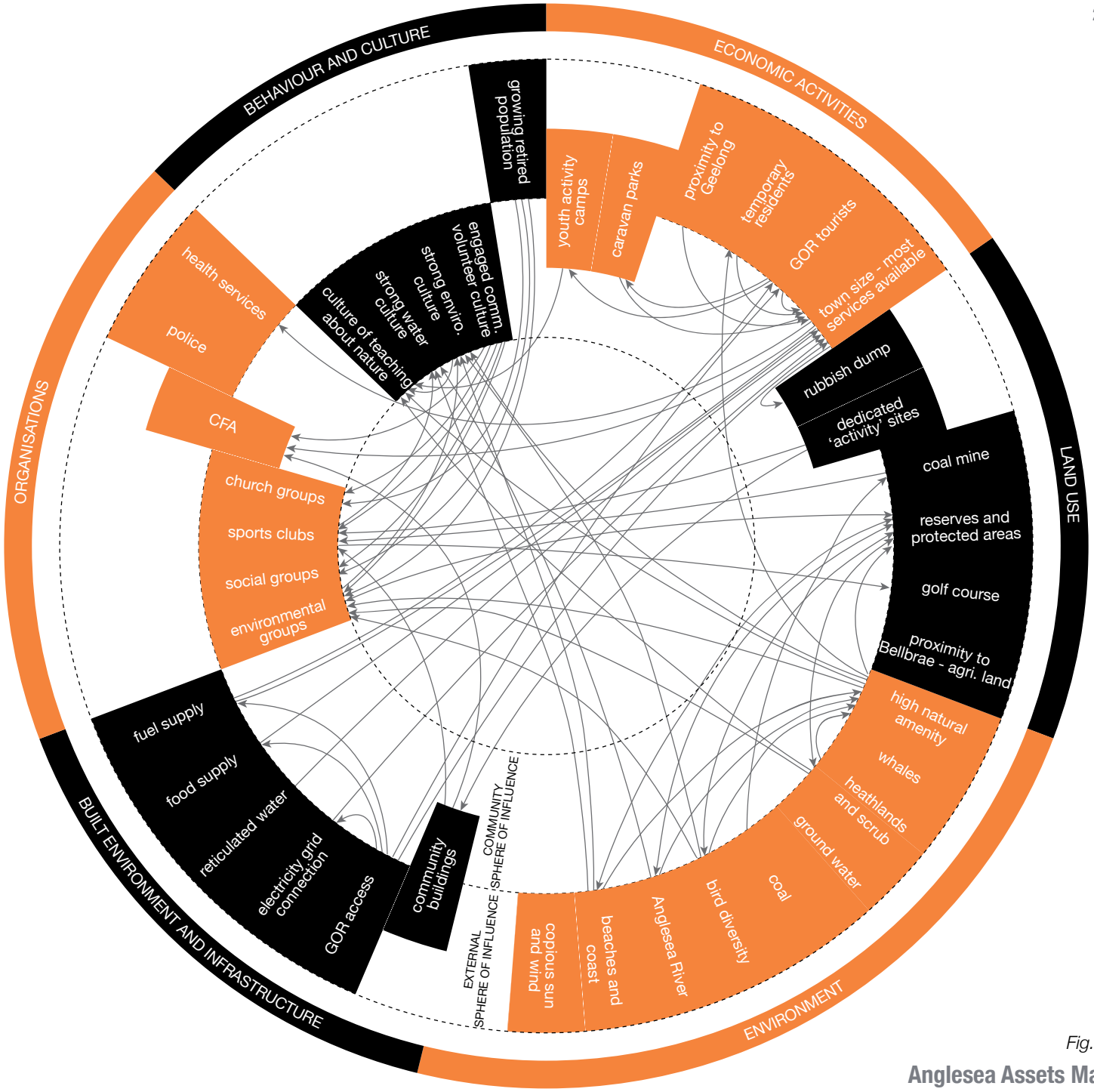


Fig. 2

Anglesea Assets Map

Creswick

Creswick's identity and function is less defined by its natural environment and reliance on tourism than Anglesea. Social and organisational assets play a larger role in shaping the town of Creswick and its surrounding ward (Fig. 3). Features such as its heritage buildings, the number of primary schools (3), volunteer groups and the diverse knowledge base spread across the community are particularly important. As with Anglesea, Creswick is highly dependent on critical infrastructure assets that lie outside the community's sphere of influence.

Assets under community influence are mainly socio-cultural and organisational. Sporting groups, multiple arts groups, the community house and the strong volunteer ethic were examples identified. Factors such the town's collective knowledge across forestry, land management and the arts, and its recent experience of flooding are also important.

Approaching Creswick from the south-east


The old Creswick post office

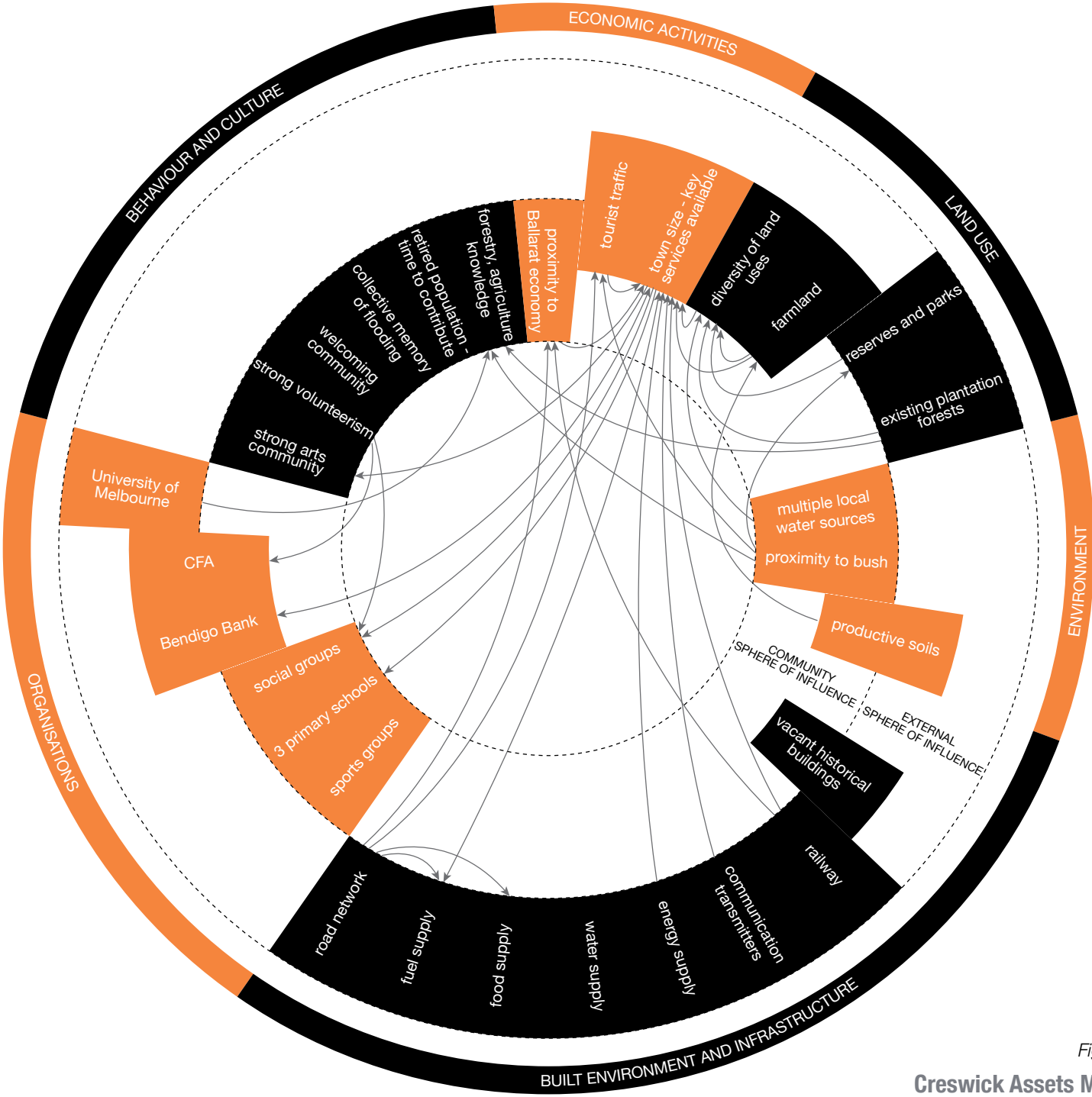


Fig. 3

Creswick Assets Map

Mapping vulnerabilities

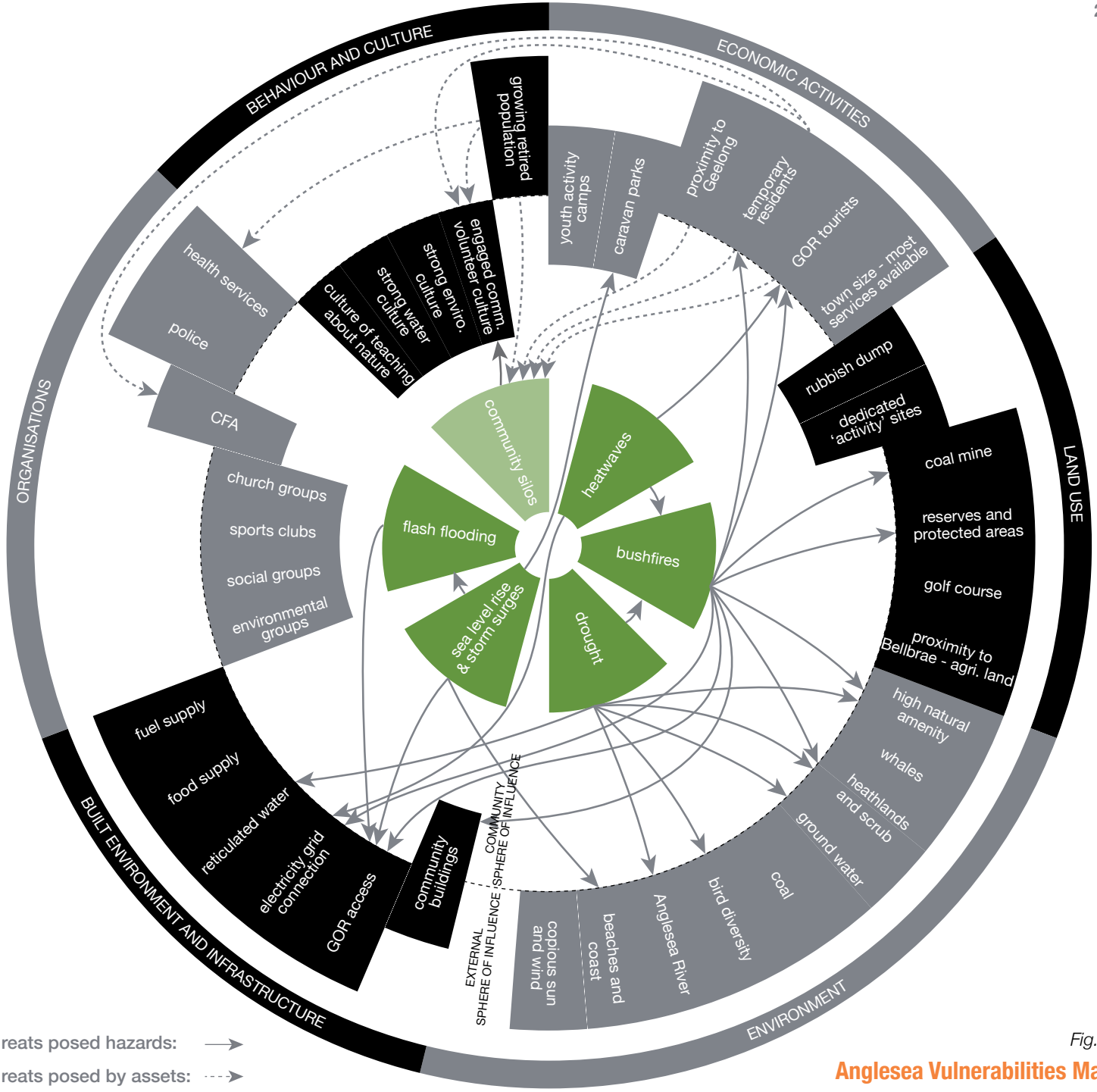
Workshop participants used the asset mapping results in conjunction with a worst-case climate scenario to identify vulnerabilities. Vulnerabilities were identified wherever assets were threatened directly by climate hazards or where asset failure would trigger secondary 'knock-on' consequences. Knock-on consequences are identified through the asset relationships defined in Fig. 2 and Fig. 3. Workshop participants also proposed non-climate hazards they felt were significant.

Anglesea

As shown in Fig. 4 there are five main threats from climate change in 2037. Bushfires and drought have the greatest potential to affect Anglesea directly, particularly through their impact on 'keystone' infrastructure and natural amenity assets. Bushfires directly threaten the healthland ecosystems, the built environment, energy and water supply. Critical functions including food supply and access to health and emergency services are also vulnerable to fire blocking the GOR. Drought also has a pervasive impact on the town via impacts to water supply and many of the town's natural assets. Fire and drought have potential to impact the tourist population and local economy and indirectly affect most social assets. Sea-level rise and flash-flooding were also identified as threats to assets – particularly via disruptions to the GOR.

Participants identified multiple non-climate related vulnerabilities and hazards. Some had also been identified as assets. The town's reliance on tourism and the GOR was seen as a vulnerability because neither could be replaced. Community silos (and the lack of social cohesion) was also identified as a critical weakness that undermined the town's organisations and cultural assets (see Figs. 2 and 4). Participants pointed to segmented population groups in the town as a key reason. Segments included those locally employed, commuting workers, the elderly and temporary residents, and transient tourists. These groups were seen to rarely mix because of different everyday priorities. Resource scarcity, particularly oil supply volatility was also seen as a hazard because of its threat to tourism and freight services.

Eroding cliffs near Anglesea Caravan Park



Threats posed hazards: ⟶

Threats posed by assets: ⇢

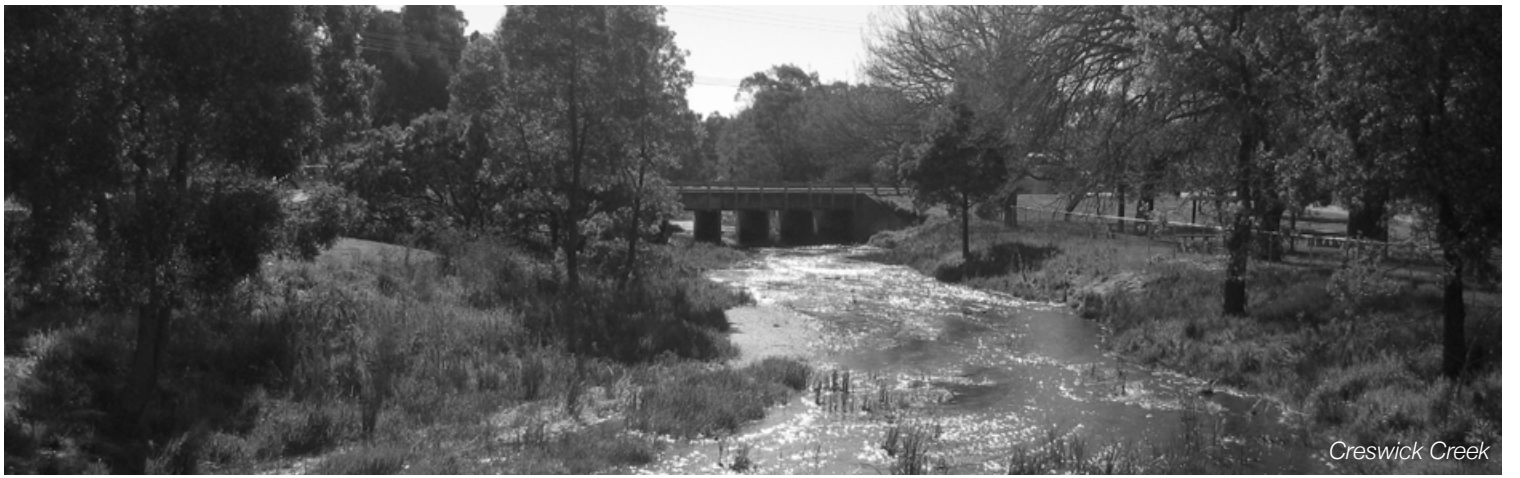
Fig. 4

Anglesea Vulnerabilities Map

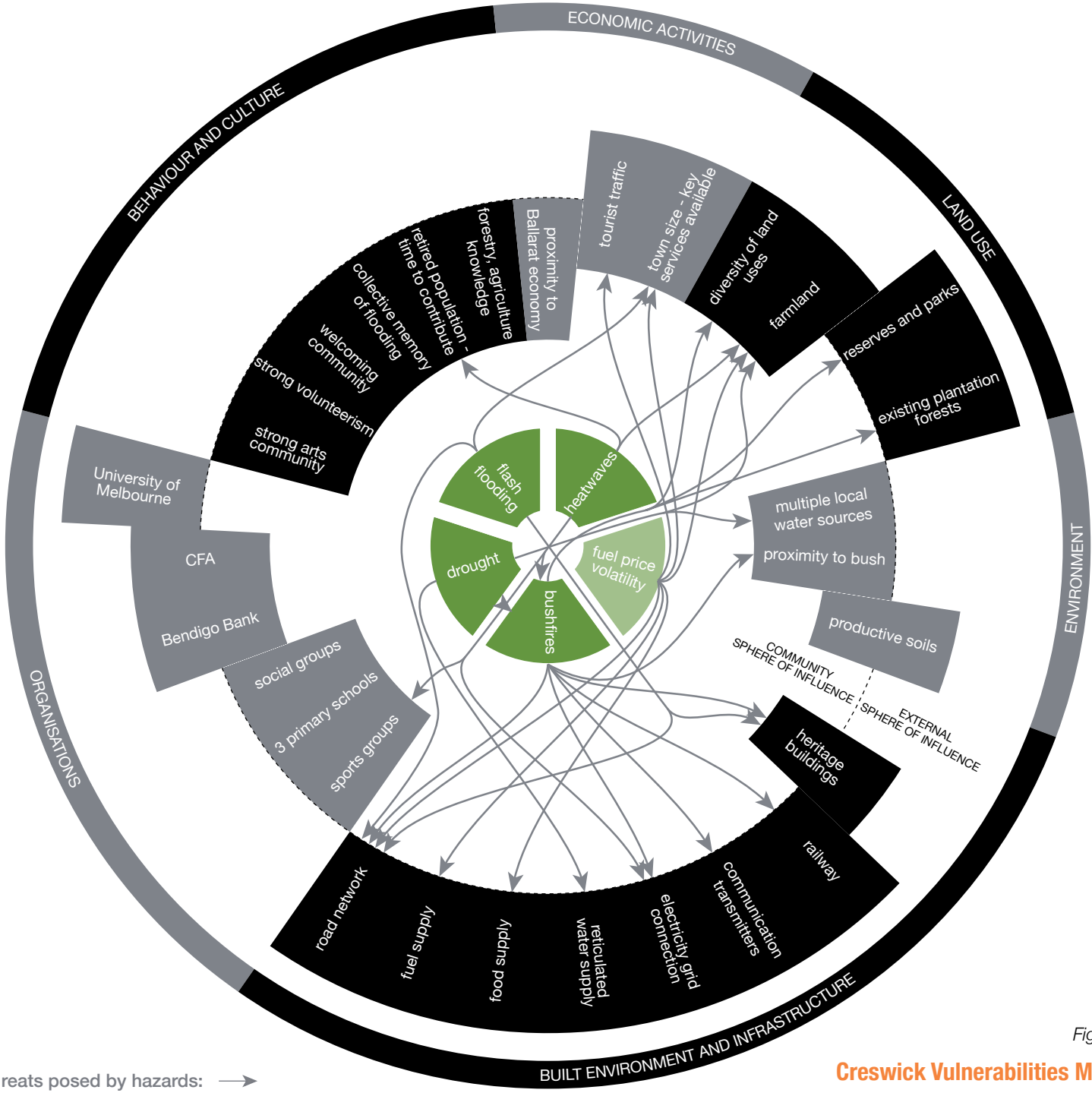
Creswick

Bushfires pose the greatest short-term threat to Creswick. Assets threatened by fire include critical infrastructure (electricity supply, rail and road access), the town's natural amenity, forestry resources and other productive land uses (Figs. 3 and 5). Drought contributes to fire risk and poses a more insidious threat by undermining ecosystem health and other productive land uses; in turn, undermining the town's economy. Drought was also seen as a key concern for Creswick because of the town's reliance on external water supplies. Because water supplies come via the much larger town of Ballarat, Creswick residents saw their town vulnerable to water rationing; they perceived Creswick to have lower priority than Ballarat. Flooding was seen first as a temporary threat to low-lying businesses and homes, but also through its ability to undermine social and economic capital over years. People also noted the psychological impact of flooding. After recent floods some residents became stressed during periods of intense rainfall. Heatwaves were also discussed in terms of their social impact, particularly on elderly residents. Heatwaves were also known to cut the time residents spent on volunteer activities.

Participants identified fuel price volatility (stemming from oil supply shortages) as the most significant non-climate related hazard of the coming decades. This was perceived as a threat to food supply, agriculture and other assets underpinning the town's economy. Residents also noted the influence of community silos and a general sense of apathy and lack of cohesion as internal threats to the town's resilience.



Creswick Creek



Threats posed by hazards: →

Fig. 5

Creswick Vulnerabilities Map

Interpreting map results

The asset and vulnerability maps derive from a rapid assessment process. Despite being limited by time, their level of detail shows the importance of local knowledge in identifying factors critical to disaster mitigation. The maps indicate four main lessons.

Asset redundancies make Creswick less vulnerable than Anglesea to certain hazards. Compared to Anglesea, Creswick has more access routes (six versus two) including roads that bypass fire prone areas and a functioning railway giving it different mode options for transport. Anglesea relies solely on road access through fire prone scrub. Anglesea's electricity is also via supply lines that pass through scrub east and west of the town while Creswick can be supplied from multiple directions. Creswick also has access to multiple water sources (dams, flooded mines and lakes) not available in Anglesea.

Relationships of reliance and control influence vulnerability to climate shocks. In both towns, residents have little influence over critical infrastructure and natural amenity assets and are reliant on external organisations for resource supply. Their dependence reflects the durability of supply systems and the high level of trust people have in them. This durability and dependence also means many assets are at risk from infrastructure failure. Being connected to vast supply networks can support resilience through functional redundancy but it leaves communities at heightened risk. External network managers may not always make decisions in the interest of local communities. This risk is often downplayed because service disruptions rarely occur and utilities have regulated service obligations. However, there are frequent examples of disruptions leading to supply rationing and the risk of trade-offs between different communities or between community and organisational interests. In a review of Australian food supply chain resilience, industry decision-makers did not feel responsible for supplying people in a disaster if this conflicted with company interests [67].

Critical assets can also represent vulnerabilities. Climate hazards are not new to Anglesea or Crewick. Fires, heatwaves and flooding are part of the landscape. People, organisations and infrastructure have co-evolved a level of resilience where most shocks are limited. Resources for recovery also exist when failure occurs. This situation stems from beneficial co-dependencies built over time. However, in some circumstances the same dependencies mean impacts propagate easily and increase the consequence of failure. Furthermore, impacts that trigger multiple failures can be more difficult to recover from; the synergistic relationships between assets no longer exist. For example, in both towns, social and organisational assets support a culture of inclusion and volunteering but are also dependent on this culture to survive. Failure in one can lead to failure in both. Results suggest both towns would benefit by identifying co-dependencies and testing the outcomes if assets involved were to fail.

Building resilience requires balancing long and short-term priorities. Infrastructure assets are the vital organs for Anglesea and Creswick. Maintaining functions like water, food and energy supply is clearly critical. Both towns are also dependent on non-critical functions underpinning subtle features like identity and culture. Loss of assets such as natural amenity and volunteer cultures won't cause immediate crises but will still undermine the survival of the community or economy over the long-term. Both contribute to social cohesion and capacity to change for example. Many asset co-dependencies suggest neither town can rely on resilience building strategies that only protect vital assets. Strategies may work best in the long-term by targeting multiple vulnerabilities in physical and social functions simultaneously. For example, securing resource supplies in ways that build social cohesion or economic value. Interventions must avoid the short-term protection of critical functions at the detriment of vital assets like social capital.

The convoluted relationships of influence and dependence shown in the maps (Figs. 2-5) emphasise the fluid nature of Anglesea and Creswick; neither can be clearly defined. This intricacy suggests interventions to build resilience will involve unexpected outcomes. Again, this issue stresses the importance of interventions being context specific. It also re-enforces the importance of agency-community partnerships because having local acceptance of intervention strategies means unintended outcomes are more likely to be accepted [68]. These partnerships are essential to help co-generate, share and interpret detailed knowledge of context. It is not feasible to expect external emergency management experts to design effective local interventions alone.

3.2 Visions of resilience

Workshop participants developed a series of desirable propositions showing how their communities could address risks from climate extremes. These were created after exploring assets and vulnerabilities in each town and applying the design principles outlined on page 20. Propositions were transformed into a set of seventeen 'visions of resilience' including narratives or summary descriptions. Each vision offers a coherent glimpse of the future from 2015 to 2037. They are explicitly positive and depict key mechanisms used to build local resilience. Eleven visions were developed from Anglesea workshop and six from Creswick. The different numbers reflect a simplification in the process following the first workshop in Anglesea. The visions shown on the following nine pages are a representative sub-set. A full set of visions can be found on-line: www.ecoinnovationlab.com/project/visions-of-resilience/

Each vision reflects local conditions and the values and aspirations of workshop participants; each is unique. However, as a set, the visions share many of the same approaches to building resilience. In particular, they:

- harness or re-configure local assets to increase the diversity of critical functions – often in novel ways. Examples in Anglesea include using the mine site for water storage and addressing land shortages (page 41).
- create relationships to build local decision-making capacity and support knowledge transfer between community and EM agency stakeholders. Creswick's Resilience Centre (page 34) incorporates multiple strategies to do this.
- foster social cohesion as a way to celebrate and harness local strengths. One example was an-intergenerational mentoring program proposed in Anglesea (see website).
- replicate or increase control over critical functions that lie outside local ownership. The Creswick Water Bank is a good example (page 36).
- build institutions to enable shared ownership or governance. Both communities developed visions involving some form of commons, including flooded areas along the creek and Resilience Centre in Creswick (pages 35 & 34).

Along with each vision you will find icons indicating how resilience is supported.

 = Diversity

 = Redundancy

 = Modularity

 = Enhanced feedback

 =Adaptive capacity

 = Impact avoidance

Creswick Resilience Centre - 2018

Creswick leads the way

More flooding and a few bushfire 'close calls' have prompted residents to form a shared activity centre and knowledge bank in the old Post Office. This Resilience Centre is a bridge between community groups and acts as a representative platform for the community to negotiate with government agencies.
The focus of the "RC" as it's known, is to reduce local vulnerabilities and build capacity to create desired change. It is a library-like repository for skills, tools and other resources needed to navigate a future with more natural disasters. The re-use of the Post Office was the first example of a growing network of "RC's" set up by communities around Australia to address local vulnerabilities to natural disasters.

A response to local challenges:

- Some sections in the community aren't well connected while other community groups are strongly 'siloed'; youth and the elderly; tourists and residents, born-and-bred locals and recent arrivals. This disconnection limits the community's ability to make the most of their social assets.
- Extended periods between natural disasters mean people often forget the lessons learnt and lose sight of what needs to be done. This leads to re-inventing the wheel when the next event occurs.
- Residents are unsure where to go (that's safe and central) if they want to leave their homes in a bushfire.
- Community members have noted a lack of cohesion and a common purpose - a sense of 'who we are' is missing.

Key elements and opportunities:

- The centre hosts idea sharing and encourages debate with the aim of increasing and strengthening regional resilience. A range of events and activities ensures most community members use the facilities.
- A training, tool and machinery library supports homes and property owners to prepare for fires, drought and floods.
- Strong links with organisations such as The University of Melbourne Creswick Campus allows talks and debates at the 'RC' to attract new ideas and support the co-design of 'citizen science' research projects.
- Emergency communication and on-the-spot charging facilities are available.
- The 'RC' hosts a 'sister-community' ambassador program designed to share knowledge, stories and experience between communities facing similar vulnerabilities.
- The centre collects and displays data relevant to the health of the region, climate related risks and the state of essential resources – such as the community's water reserves.

Embracing the Flood - 2025

Moving to higher ground

After frequent flooding, the Creswick community decided the best long-term solution is to turn the low-lying flood plain into the Albert Street 'Commons' and relocate flood-prone homes and businesses uphill to the Station Precinct. The land made available is used for multiple purposes including habitat regeneration and flood mitigation, recreation, education, and food production. Creswick's rail connection to Ballarat is proving essential to the town's economy. With most of the commuting done by rail, the Station Precinct is also enjoying increased foot traffic and trade. A diversity of local products and produce are sold and loaded directly at the station.

A response to local challenges:

- Big floods are more frequent and pose a serious risk to low-lying homes and businesses.
- Channelling the creek and raising the banks to reduce flood risk has made flooding worse downstream.
- Regulating the creek to reduce flooding has affected high value habitat – the Growling Grass Frog hasn't been seen for years.
- Despite drainage and road-works, Creswick is split when the main road is flooded.
- The creek is treated more like a drain for Creswick. It's not valued and makes no contribution to the town's character.
- Fuel price increases mean road transport is less feasible. Local commuters and small business freight need new ways to travel.

Key elements and opportunities:

- Allowing the creek to flood its banks will reduce down-stream flooding.
- Opening the town to the flood plain turns the creek into a natural asset – a key part of Creswick's character.
- Low-lying land is re-zoned for uses that accommodate flooding and provide shared benefits – habitat regeneration, space for recreation and agricultural production.
- Re-locating low-cost housing and commercial businesses to the Station Precinct helps ease the shift from road to rail freight. It also maintains a way to connect and trade with other towns.
- The greater commercial importance of the railway means Raglan and Victoria streets become prominent 'boulevards' connecting the town centre to the Station Precinct.

Creswick Water Bank - 2023

Drought-proofing the town

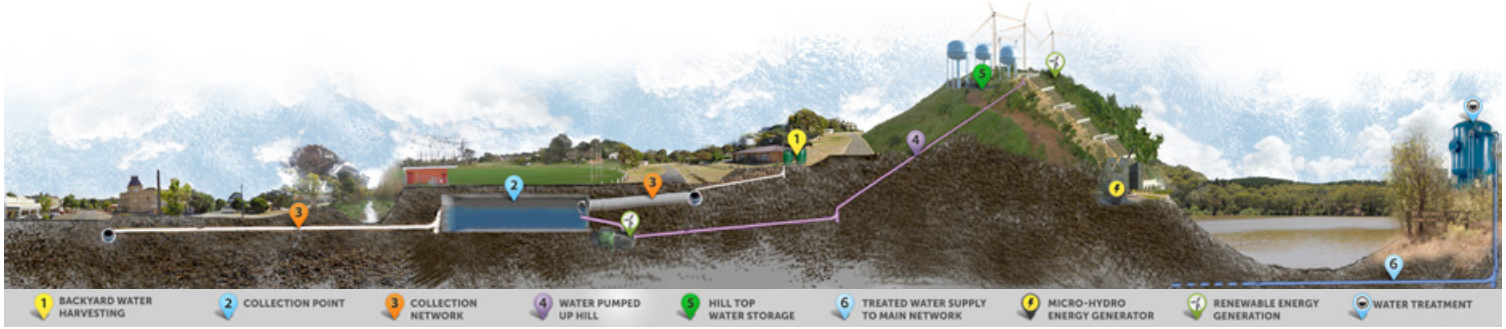
Creswick residents have responded to ongoing water scarcity to form the Creswick Water Bank. CWB is a distributed supply network of diverse, interconnected water sources. Water is stored in reservoirs on the hills surrounding the town and connected to micro-hydro turbines. Opportunities for new local services and businesses have opened up to sustain the water grid. These include tank cleaning, meter reading, network maintenance and even water-trading services.

A response to local challenges:

- There's less water to go around and the droughts have been getting worse.
- Creswick is totally dependent on external sources of energy and water. During a 'big dry', larger towns like Ballarat get priority and water quality can often suffer.
- More frequent heat waves and storms mean black-outs are frequent. Energy certainty is a key challenge for pumping water.

Key elements and opportunities:

- Surplus rainwater captured from households is collected and stored as a shared resource. Suppliers are compensated depending on the volume and quality of their contributions.
- Small-scale renewable energy is used to pump water from collection to hilltop storage points. Water quality is tailored to water demand.
- Hilltop water storage acts like a battery – generating energy using micro-turbines as needed.
- Water is collected from multiple sources such as dams, reservoirs, the creek, stormwater and rainwater - creating redundancy and flexibility.



Creswick Timber Manufactory - 2025

Building on tradition

A micro-industrial hub built around 'high-end' and bespoke processing of timber and wood products situated east of Creswick. The Manufactory grew out of recognition that a strong local forestry industry depends on building partnerships to develop niche opportunities for value-added timber products. The industrial and knowledge base for this vision grew out of the remnants of the Australian Centre for Advanced Wood Processing and was inspired by Scandinavian examples of forestry-based industrial ecologies. With energy generation, resin processing and innovative manufacturing side-by-side, The Manufactory is a small but highly innovative contribution to the local economy.

A response to local challenges:

- Rising temperatures and drought have increased fire risk to the plantations around Creswick. Numerous 'close shaves' have also made people question the value of nearby plantations.
- Changes to weather patterns and evaporation rates are threatening the viability of existing Pinus Radiata plantations.
- Profitability of established softwood plantations is undermined by fluctuating costs of production and overseas competition – long-term viability is questioned.
- Road transport costs have risen dramatically due to petrol-price increases.

Key elements and opportunities:

- In addition to local jobs and apprenticeships, the Manufactory's bespoke, carpentry, wood shaping and timber processing facilities provide a range of vocational and tertiary training opportunities.
- Products are loaded directly and distributed via adjacent rail. The local workforce also commutes by rail.
- Timber waste is used to generate electricity on-site. Excess energy is sold to the grid.

Creswick Agri-Hub - 2017

A local food economy

A community-owned facility designed to link and support small business at all stages of the food supply chain throughout Hepburn Shire. The Agri-Hub offers a permanent site for linking local producers to local retailers, processors and other food markets. With a permanent market site, cafe, commercial kitchen and food processing facilities, the Agri-Hub supports multiple activities such as the sharing of knowledge in land management and production techniques through to energy and nutrient recovery via composting and biogas generation. The Agri-Hub builds on Creswick's existing strengths in land management and food production and its proximity to fertile country.

A response to these challenges:

- The average age of people working as primary producers is over 50, threatening inter-generational transfer of valuable local knowledge.
- Food producers are heavily reliant on large retail monopolies and a lack of access to medium-scale markets.
- Erratic seasonal weather is pushing farms without income diversity to the limit. Rising fertiliser costs have also added significantly to cost of production.
- Households lack access to cheap, fresh produce and rely increasingly on out-of season foods dependent on freight.
- Rising oil prices and frequency of droughts have cut the viability of existing food producers. New models of production and distribution are needed.

Key elements and opportunities:

- A community owned facility – designed primarily for the area's existing food producers but with an emphasis on wider partnerships and sharing knowledge.
- A focal point to support the development of small value-added food businesses.
- Food waste generated on-site is converted to biogas nearby with the by-product sold as fertiliser.
- Proximity to the railway and Station Precinct, allows produce to be exported to the wider region via rail.

Anglesea Eco-Tourism Institute - 2021

A centre of excellence

The Anglesea Eco-Tourism Institute is a satellite campus of Deakin University in Geelong. It has an emphasis on vocational training and is designed to embed students in the community using home-stays. Local outdoor tourism businesses are involved in the development of the Institute's unique curriculum. Courses cover eco-tourism, environmental education and community leadership - all are co-taught by locals and involve business placements. The centre is also an exemplar of ecologically sustainable design (ESD) and forms a part of the Anglesea Oasis – a respite area for the community and tourists during heatwaves and bushfires.

A response to local challenges:

- There are limited local employment opportunities in Anglesea and the town is overly reliant on tourism for income.
- Anglesea's strong culture of volunteerism is at risk. An ageing population, younger resident families spending more time commuting to work and the high proportion of temporary residents in the population mean people have less time to give.
- Anglesea doesn't have a place of refuge during extreme conditions such as heatwaves.

Key elements and opportunities:

- The Institute helps diversify education and employment options and supports the local economy by bringing external students to live in the town during semester.
- The Anglesea community has strong local knowledge in environmental education, nature-based tourism and outdoor recreation. The Institute takes these qualities and builds on them, creating a more advanced, vocational, 'train-the-trainer' environment.
- The Institute creates the physical and social infrastructure for younger people to live in Anglesea and build meaningful connections with the community.
- The Institute is an exemplar of ecologically sustainable design, demonstrating the highest standards of thermal passive design suitable for Anglesea.
- The Institute is open 24/7 as part of the Anglesea Oasis - providing a place of refuge and respite during extremes.

Angelsea Market Garden and Harvest Festival - 2024

A new food identity

Anglesea has a thriving local food scene known across southwestern Victoria for its high quality, fresh, local produce and excellent hospitality. The focal point of activity is the Anglesea Market Garden and Training Centre. The restaurant, located on Anglesea's market garden site, specialises in seasonal, indigenous and local food and provides training in hospitality and food processing. The market garden hosts an annual Harvest Festival, which draws the whole town together to cook and celebrate good food.

A response to local challenges:

- The majority of Anglesea's economy relies on tourism. Few other job and income opportunities make the town's economy highly seasonal and vulnerable to a drop in tourists.
- Most of Anglesea's food supply is dependent on long-distant transport.
- There are few training opportunities in Anglesea, meaning people have to move away or travel to access further education.

Key elements and opportunities:

- The market garden provides business opportunities that are not tourism dependent and help retain money within the local economy by reducing food imports.
- Localising food production can help improve access to quality food, support the development of valuable skills and diversify food sources - all increasing food security.
- The Harvest Festival provides a focal point for residents and non-residents to come together – strengthening the community and building Anglesea's unique identity.

Anglesea Lake - 2027

Shifting the town focus

Anglesea Coal Mine is closed and allowed to fill with water. The lake is used as a heat sink for a water-source cooling system that supplies community buildings (including the Anglesea Oasis - page 39) with low energy, low cost cooling. Anglesea Lake also becomes a focus for water sport activities such as rowing that aren't suitable for the open sea. Disturbed land around the old mine site provides a rare opportunity for the development of low-rise, high-density housing and a renewable energy park (with solar, wind, and geothermal energy generation). A walking path along the Anglesea River linking the coast to the lake encourages locals and tourists to explore the area and connects the existing town to the new precinct.

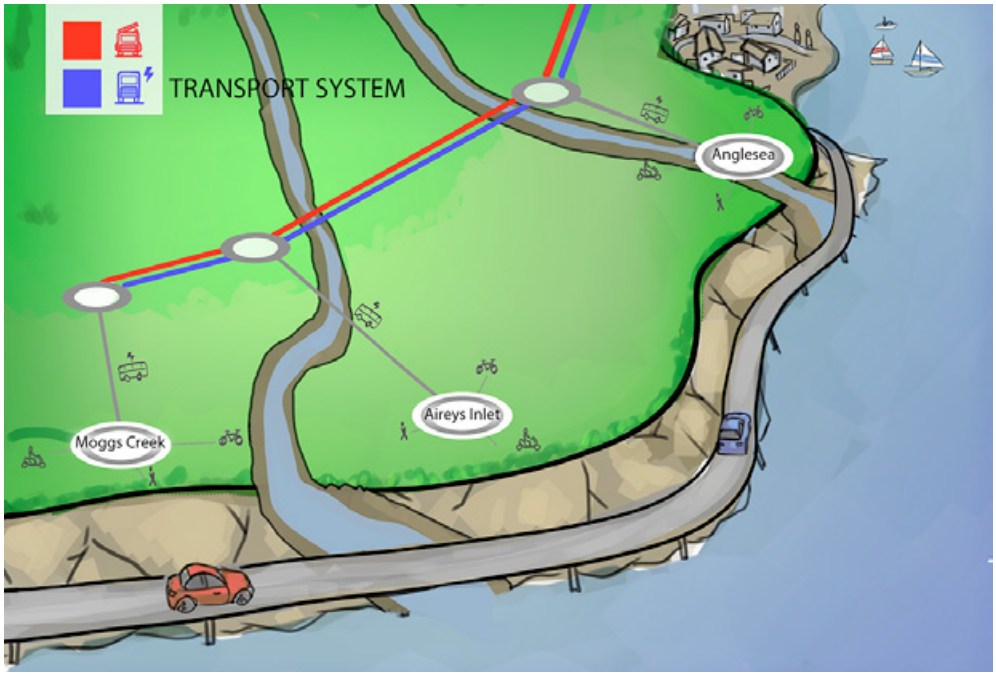
A response to local challenges:

- Increasing heatwave frequency and intensity will put the young and elderly residents of Anglesea at risk and increase demand on the grid for expensive air-conditioning. Central Anglesea can be too hot for residents during heatwaves and there is a need for reliable, low-energy 'cooling' services that can supply community buildings.
- Sea level rise will cause erosion and impact coastal amenity. This may see a reduction in the importance of the town's adjacent beaches.
- Over time, rising sea levels will require a rethink about the location of the town centre.
- The threat of bushfires is highest from the north-west – where the mine is positioned. There is a real threat the coal mine could catch alight in a bushfire with smoke affecting the adjacent town.

Key elements and opportunities:

- The lake provides a physical buffer from northerly bushfires and an additional water source (not reliant on mains supply) for fire fighting and drought-proofing the town.
- Disturbed land around the mine site provides an opportunity for new building to occur without impacting the surrounding heathland. It also allows the town to shift away from low-lying areas at risk from rising sea levels or flash-flooding along the Anglesea river.
- The riverside walking path helps link the current town centre to the new precinct and lake activity area.
- The solar-powered cooling system provides a robust service that does not rely on the grid.

Inland Rapid Transit System - 2028



Encouraging low-impact transport.

An inland dual-mode Bus Rapid Transit (BRT) service and emergency service vehicle lane connecting Geelong, Bellbrae, Anglesea, Aireys Inlet and Moggs Creek. Electric mini-buses meet with the BRT service, running regularly to and from inland stop-off points along the inland route into each town. Bicycles and small electric vehicles are available for travel around town.

A response to local challenges:

- There is significant stress on the road infrastructure in Anglesea during summer months when the tourist population is high.
- Traffic jams and accidents can block access for emergency services and increase the risk to commuters from bushfires.
- Sustainable transport options are limited when traveling to, from, and within Anglesea.

Key elements and opportunities:

- Multiple low-impact and public transport options reduce road blockages, vulnerability to rising oil prices, and vehicle density on the Great Ocean Road (GOR).
- Emergency services vehicles have rapid access regardless of tourist numbers on the GOR.
- The introduction of new transport options creates novel tourism opportunities.

Implications

The visions of climate resilient Anglesea and Creswick are evidence non-expert stakeholders can make valuable contributions to the design of local responses to climate vulnerability. Some visions involve aspects that would be challenging to implement; objectives that may be more achievable by alternative means. However, they show significant creativity and sophistication in their sensitivity to context and capacity to address multiple risks simultaneously. They also provide a diversity of ambitious, inspiring strategies. As a suite of proposals, the visions also show a pattern of aspirations demonstrating common themes. These make transparent the changes people feel would benefit their lives when threatened by extreme climate conditions.

The visions share a strong theme of community agency. Fifteen of the seventeen visions involve community stakeholders in leadership, governance or management roles. The two visions without some level of community control – an administrative Great Ocean Road Resilience Zone (not shown) and the inland transit system (page 42) in Anglesea – were not at scales relevant to community leadership. Interestingly, the visions' emphasis on local agency contrasts to research showing communities have an unrealistic expectation of EM agencies as crisis solvers [44, 45, 69]. Results suggest there is a strong link between community aspirations, their level of buy-in and their sense of responsibility. Potentially, by allowing community stakeholders to freely explore how they want future risks to be addressed, the workshop and visioning process enabled them to let go of some expectations of government. When proposed changes are linked to what people value and understand locally, having community members play a leadership role makes sense. In Anglesea and Creswick, resilience is largely home grown.

The visions also show how strategies for addressing climate hazards may best exist in an ecosystem of diverse functions and services. In the visions, risk mitigation outcomes are inseparable, or even secondary, from other 'everyday' benefits. For example, aside from improving the town's drought security, the Creswick Water Bank concept sees residents gain new sources of revenue (through water trading) and benefit from new business opportunities. Similarly, the vision of Anglesea's building retro-fit business directly aims at community development but does this through addressing the fire-proofing and energy and water efficiency needs of the local building stock. The intricate links between risk mitigation and other beneficial outcomes in most visions suggests agency-driven resilience strategies may struggle to get community buy-in unless they serve a purpose or have meaning on a day-to-day level. They also highlight the downsides of efficiency-driven risk mitigation. Results suggest single-issue risk mitigation strategies applied at the local level may be easy to roll-out but will require constant maintenance by agencies. In contrast, community commitment to risk mitigation programs may depend on those programs being looser in focus and able to evolve over time.

The diversity of ideas and their sensitivity to context should caution against replication of specific programs and projects to address local resilience. 'Top-down' solutions risk ignoring relevant assets, contextual problems and community desires. They also risk making local resilience dependent on assets that communities have no control over – potentially exacerbating vulnerabilities. The visions also highlight the challenges facing EM agencies to understand local contexts. They show the importance of building community-agency partnerships in designing place-based strategies. The visions also show that sensitivity to context does not require EM agencies and communities to start from scratch. A small set of design principles can provide the basis for diverse, context specific propositions.

In addition to communicating complex and provocative ideas, the visions are valuable as a process. Generating the visions gave workshop participants insights about climate risks and allowed stakeholders to imagine desirable, resilient futures collaboratively. The visioning process also helped residents explore local assets and vulnerabilities, interrogate what they valued and identify shared community priorities. Workshop feedback in both communities showed this type of deep interrogation is important for communities to re-connect with what they value and with each other. As one Anglesea participant stated to the workshop group:

"We need to get together and have this conversation with the other people [in Anglesea] as well. It's not going to happen unless we step up. It's up to us".

A further analysis of each vision, and how key components improve local resilience can be found in Appendix 8.

3.3 Opportunities and barriers for climate resilience

This section presents results from the 'pathways and barriers' workshops. These saw stakeholders from local government, EM agencies, NGO's and the community explore how to create the futures described in the visions of resilience. Outputs included critical enablers and pathways of change, and barriers and leverage opportunities.

Because outputs were specific to each vision, results have been combined and abstracted slightly. This helped to emphasise similarities and draw lessons applicable beyond the two towns. Results are translated into an influence diagram (Fig. 6) showing the relationships between enablers (inner circle) and barriers (outer circle). As with the previous diagrams, arrows reflect lines of connection and direction of influence.

Enablers and opportunities

Enablers are resources or conditions essential for a vision to be achieved. They represent opportunities or leverage points to catalyse and support change.

More than 150 specific enablers were identified from twelve visions used in the workshops. These were often described in terms that were specific to each vision or the town in question. However, when grouped by theme or function and compared, results showed a consistent set of six to eight primary enablers for each vision. These also followed a consistent pattern. The same enablers played key roles early in the change process while others gained importance close to implementation. The eight enablers are summarised in this approximate order below (and in Fig. 6) along with specific examples suggested at the workshops.

Desire for change

Recognition by stakeholders that change is either necessary or inevitable. Visioning processes, natural disasters and social dialogue were some of the mechanisms seen to motivate desire for change. Desire for change was one enabler sometimes not identified. In these cases, desire for change was assumed to stem from other enablers - like champions or a vision of change.

Common goal or vision of change

A tangible concept of what desired change could be like. Participants struggled to identify mechanisms for building a vision of change and pointed to this project as an example process. Other strategies included holding local art and story competitions, small seed grants or pointed to experiences where passionate champions developed an idea that was then adopted more broadly.

Engaged and connected community

Knowledge of the concept and a willingness within the broader community to support it. Better still – ownership of the concept by a cross-section of the community. Community engagement with the concept of change was often seen to depend on a slow process of lobbying by champions or people being galvanised by shocks or loss. The Black Saturday Fires were pointed to as an example.

Community champions

Individuals or groups with the desire and resources to 'sell' a vision of change. Champions were consistently identified as essential players and included influential locals and minor celebrities who could draw additional interest and momentum to an idea. Champions were often seen as having the ability to bridge stakeholder groups.

Capacity to influence larger stakeholders

The tools, skills and a familiarity with processes needed to engage and draw support from stakeholders with critical roles to play. Typical stakeholders were large businesses, associations or government organisations. This capacity was often linked to well connected or skilled individuals with the capacity to build new connections, find avenues to access resources and sell an idea.

Access to seed resources

Materials needed to turn the concept into reality; money, land, space and skills etc. These were seen as levers to gain additional resources - a way to demonstrate the vision's legitimacy to government and other potential supporters. Mechanisms included crowd-funding, short-term or low-cost lease agreements and partnerships with small businesses (eg. to host workspaces).

Government support

Government (either local or state) was seen to play three types of enabling roles - providing resources (to gain skills, space or additional funds), providing legitimacy (through endorsement or partnership), and to overcome regulatory hurdles.

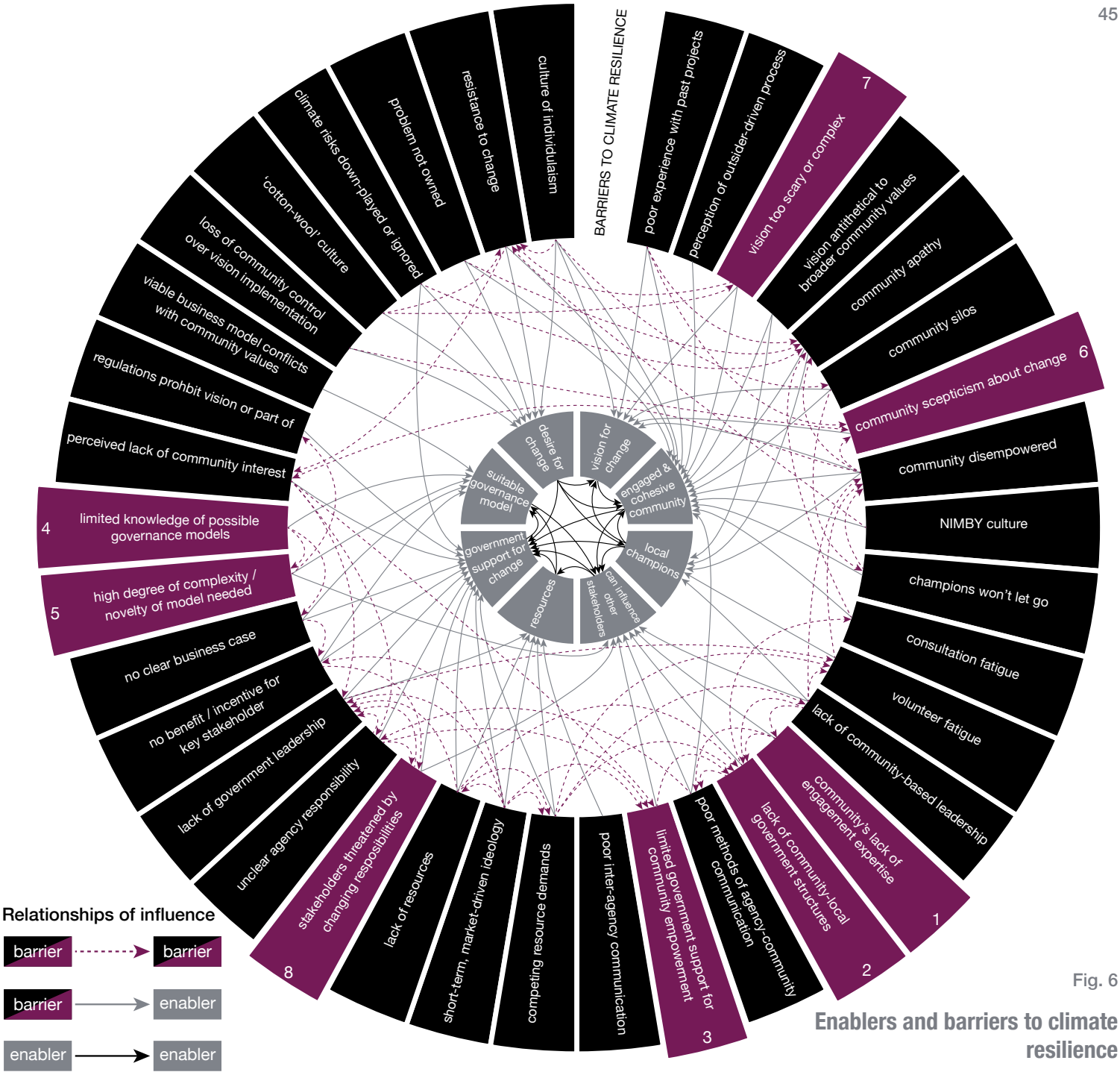


Fig. 6

Enablers and barriers to climate resilience

Governance or business models

The systems that could ensure changes were sustainable once implemented. Many of the visions involved novel concepts that required forms of management. They combined resources and skills in unusual ways or diversified key functions (such as water provision or cooling) using unusual technologies. To make these concepts work, participants saw the need for new governance or business models.

Turning radical ideas into tangible change on the ground is a convoluted and iterative process. As described in Fig. 6 specific enablers play prominent roles at key stages in the change process, but they also link back and re-enforce each other.

The pathways emphasise the importance of legitimacy and trust throughout transformative change and are consistent with findings of institutional change research [70]. Factors like social connections and formal relationships are critical in the early stages. Community cohesion, the existence of negotiating skills and networked individuals help take ideas to a point where they are 'owned' in the community. This process builds the social capital and legitimacy needed to access and lever financial and technical resources. In turn, these resources help solidify novel ways of working into new communities of practice or models of governance.

The importance of legitimacy and the slow process of gaining acceptance suggests disaster mitigation strategies designed externally and 'dropped' into communities will struggle to gain local interest or support. Resilience building programs may be best seen as part of a slow transformative process akin to the Landcare movement. A process that took many years to gain traction but eventually succeeded through the growth and sharing among innovative communities of practice. Findings should caution against central EM agencies playing a strong leadership role at the community level and instead look to facilitate and support champions or projects to galvanise community imagination.

Barriers

Barriers are factors that can undermine efforts to build local resilience. All were identified in relationship to the previous enablers.

A total of 37 barriers were identified across the three workshops (Fig. 6). Despite the diversity of visions explored, only one barrier (strong community silo's in Anglesea) was not shared between case studies.

Most of the 37 barriers reflect issues identified in climate change adaptation literature (eg [71-74]) and corroborate with findings from the reviews of preparation and response to natural disasters in Victoria (eg. [45]). These include issues relating to poor regulatory coordination, lack of resources and difficulty integrating adaptation planning into current decision-making processes.

Of the 37 barriers, eight were particularly common (often described in multiple ways for the same vision). These stand out as missing or poorly described in analysis of adaptation barriers in Australia [72-74]. These eight barriers seem to be particularly relevant to 'bottom-up' change (as opposed to barriers at government or industry level). These are described below and numbered in Fig. 6:

1. lack of community-led engagement expertise
2. lack of effective institutions that bridge community and local government
3. ineffective government-led community empowerment
4. limited experience or knowledge of novel governance or business models
5. the complexity of necessary governance or business models
6. community scepticism about change
7. visions of change being scary and complex
8. stakeholder resistance to changing responsibilities.

Barriers 1-3 reduce communities' ability to influence more powerful stakeholders. Barrier 1 points to the lack of local capacity. Participants felt communities did not have the knowledge or experience to sell ideas for adaptation to possible partners (eg. business or local or state government). Barrier 2 shows the need for formal partnerships that bring community and government agencies together as equal players in EM planning and development decisions. Participants (particularly in Anglesea) pointed to the absence of formal institutions that could bridge different scales of community and government. Research shows these so-called

'boundary' institutions are often key to solving complex problems. They are particularly useful to identify and break down differences in power between stakeholder groups allowing better transfer of knowledge and improved feedback on decisions [75]. Barrier 3 captures concerns about the failure of government-led community empowerment. This issue is not new to climate change adaptation or emergency management in Australia [21] and was also raised as a problem in interviews with people from CFA and SES. Government officers in multiple agencies described a gap between government rhetoric about community empowerment and the reality of low resources, low capacity and low prioritisation. As one CFA officer put it:

"There is no clear mandate or dedicated funding for community engagement and capacity building...program funding in this space is small and piecemeal"

CFA Officer, Melbourne

Barriers 4 and 5 undermine the sustainability of innovative partnerships and enterprises. Many of the visions propose collaborative organisational structures that are rare. They suggest traditional private enterprise, charity or purely government-funded service models aren't a big part of desired solutions. Proposed models included shared knowledge commons ('Wiki's'), crowd-funding and local investment arrangements and community owned utilities. These types of organisations are appearing with the growth of collaborative economies [76] but are not yet part of the daily 'toolkit' for emergency management or community development agencies.

Barriers 6-8 capture how significant and rapid change in society can be scary and disempowering. Many participants were wary of the visions and the broader trajectories of change they convey. This was expressed in various ways. In particular:

- Community and agency representatives saw the rhetoric of local resilience hiding a state government agenda to devolve responsibility. They doubted this would be matched by the commensurate resources.
- EM agency and council officers resisted sharing the privilege of expertise, democratising decision-making processes, and increasing transparency on planning decisions.
- Community members resisted being responsible for leading climate adaptation.
- Most stakeholders were challenged by changes to their familiar roles and identity.

Assumptions of change

Throughout the project, the research team encountered multiple forms of resistance to the concept of non-linear future change. For example, when first asked to imagine the world of 2037 in the visioning workshops, most people described conditions today. Only after leading people to question their assumptions of change and be more open to what might exist, were more radical ideas forthcoming. Yet these visions met strong reactions from agency officers and members of the public for describing an unfamiliar future. We expect some readers of this report will have similar reactions to the visions. Visions depicting changes to industry or land-use were often seen as fanciful, lacking relevance to current decision-makers or involving too much change. For example, the transformation of the Anglesea coal mine to a lake was particularly polarising as 'impossible' over the next 25 years (or even 50). Yet, just 18 months since the idea was proposed, the mine owners are looking to sell and the community are campaigning to close and transform the mine for another use (many proposals involve a lake).

The dismissal of 'radical' change underlines an important problem and paradox. People wanting major problems like climate change to be addressed can be highly sceptical about non-linear change, even though big problems require radical solutions. The failure to imagine how risks, planning practices or social behaviour could be radically different undermines our capacity to adapt and prepare.

Human thinking is shaped to expect the future will be like the past despite all the evidence to show otherwise [77].

3.4 Process Evaluation

Using design-led approaches to support disaster resilience at a local level is rare in Australia. While examples exist [78, 79], the thinking and methods used in this project are only entering the planner or emergency manager's 'toolkit' at an experimental level. Hopefully this will change. Results suggest the method developed can benefit natural disaster management and climate change adaptation planning in areas where innovation is needed. Here we highlight the key strengths and areas for improvement.

Strengths

Facilitating a collaborative exploration of climate extremes

Building local resilience to climate extremes requires communities to be aware and engaged. The process was successful in creating a 'safe space' in which community participants could explore polarising issues around climate change and its potential impacts. It also enabled local stakeholders to create complex proposals for a more resilient future. These included transformative changes that departed from the status quo. Outcomes show it is possible for community stakeholders to consider major change in the environments they care most about. Furthermore, participant feedback after the visioning workshops highlighted a strong desire for change. The workshops were catalysts for new thinking.

A catalyst for community-led change

A key theme discussed by workshop participants in Creswick was the need to build social cohesion as a means to support adaptive capacity and resilience. From this, a number of community members have established a local project that taps into Creswick's social and creative strengths - Pavilion Arts is "An organisation dedicated to the use of the arts to develop connectivity and resilience in the Creswick Community." [80]

A low-input process that is widely applicable

Planning and EM agencies don't have the resources to run extensive evaluation processes in every town. The process requires prior preparation and some technical (climate system related) input but only three days of workshop participation. The longest single time commitment from participants was ten hours over two days. Results indicate this process put limited demand on participants while achieving multiple outcomes; communicating risks in a tangible way to non-experts; identifying community values and aspirations, and opening up broad discussion about directions and avenues for change.

The process was designed to explore challenges at the community level but could be easily adapted for agency or business contexts.

Effective identification of barriers

Building resilience will encounter institutional resistance. Where possible, change-agents need to be aware of these barriers before designing interventions or encouraging innovation. Results show the method is capable of exploring and identifying barriers relevant to state and local agencies and community stakeholders. In addition to identifying issues that concur with research into barriers in climate change adaptation and EM literature [72], the method is able to explore more subtle challenges relevant to bottom-up processes of change.

Areas for improvement

Tailoring the method to match local government decision-making processes

New tools for supporting climate resilience need to demonstrate how they relate to existing decision-making processes and what additional 'value' they offer. The 25-year time frame and the level of ambition of many visions left some in Hepburn and Surf Coast Shire Councils questioning the relevance of the results. This reaction partly reflects a misunderstanding of the project's intentions but also highlights the gap between traditional planning practices and methods for designing strategic responses to complex long-term challenges. Further evolution of the method is needed to link outcomes with existing council planning and emergency management procedures. Changes could involve developing and framing visions as a series of component projects and programs that can be more easily matched to current planning aims and resource priorities. Breaking down visions into tangible elements and steps would have increased their salience.

Improving the engagement and feedback process

Feedback on the visions from community members was disappointing in both towns. The website and facebook page each attracted thousands of views, but garnered minimal comments (see Appendix 7). A more substantial media and engagement strategy is required. Anecdotal reports of community conversations prompted by physical posters placed around the towns suggest opportunities to gather feedback were missed.

Increasing community representation

Participation at the visioning workshops did not reflect community diversity in either town. Key groups such as commuting workers, non-residents (Anglesea) and children were missed.

Diversifying case studies

Two case studies cannot represent the diversity of communities and towns across Victoria. Creswick and Anglesea were chosen primarily for their exposure to different climate impacts and the commitment of their Shire councils to the process. In hindsight, both towns share many attributes that limit how widely lessons may be drawn. Both are rural in character, of similar size and have ethnically uniform populations. They also have a history of periodic natural disasters and share a strong volunteer ethic. Results may reflect communities with more collective initiative, greater engagement with natural disaster issues and a lower expectation of EM agencies than the wider population. Research in Victoria [44] suggests urban communities have greater expectations of emergency service organisations than their rural counterparts. Additional case studies should target larger, more diverse communities in urban areas.

Visions of Resilience posters in the window of a Creswick cafe. Photo: A. Beyerle.

Section 4

LESSONS AND RECOMMENDATIONS

4.1 Lessons

Climate extremes will be felt most at the local level. It will be communities who confront the fires, droughts and storm-surge events re-writing our disaster records. Communities will also live with the degradation of social capital that follows these events in the years after. Results indicate emergency management practitioners are worried about this future but also believe there isn't the will or understanding in agencies to tackle the problem head-on. The overarching message from this project is that agencies don't need to tackle the issue alone.

Communities have a valuable role to play in natural disaster management. This role extends well beyond the passive, household-level response currently operating. As the aftermath of recent Australian disasters showed, many communities are capable of meeting vital needs in creative ways – with or without government sanction. The challenge lies in building partnerships and institutions to direct this creativity toward social innovations that build climate resilience.

Emergency management experts may accept that climate extremes pose a major risk to communities but aren't clear on what this threat looks like. No one knows what local resilience to this future looks like either. This challenge won't be solved with expert prediction and centrally-designed plans. This project suggests answers can only be found when expert stakeholders are open about what they don't know and start exploring what towns and regions could be like, with the communities that shape and know them best.

The process won't be easy. The project has highlighted some of the difficulties in imagining a greater level of resilience to an unknown level of risk. Society already has significant resilience. Critical infrastructure rarely fails, emergency services are state of the art, and people trust governing institutions to make good decisions. Most of the time, even during emergencies we expect and know critical functions will work. Set against a changing risk landscape, this success is part of the problem. The task we face is trying to conceive how failures might occur and to build the flexibility and diversity of functions that allow society to thrive despite climate extremes.

The method developed and tested in this project shows sophisticated community-led visions of future resilience can be created. These visions depict a level of change that redefines how people work, how they relate to each other and access critical resources. They are refreshingly provocative in their re-visioning of the future, something the authors believe is urgently needed. They challenge perceptions of the future and allow agents of change to explore leverage points for action.

We hope this project helps shift perceptions about the creative leadership role that communities can play in building resilience to climate extremes. There are four main lessons from this work. These should be read bearing in mind that more cases studies are needed to strengthen report findings.

Lesson 1:

Communities are capable of developing sophisticated strategies for building resilience to climate extremes.

Contrary to narratives about communities expecting too much of government agencies, results show community stakeholders see themselves as agents of change. When given a safe space to explore future climate risks, community participants desired a future where they had increased responsibility and control. This was shown consistently in three ways:

- The vulnerabilities prioritised by local participants involved risks to assets that communities were highly dependent on but could not influence.
- Communities looked to themselves for solutions. Desired strategies for building resilience involved reorganising existing community strengths to increase their potential or increasing community control over critical functions.
- Many of the key 'enablers' for supporting change were linked to community deficiencies and areas they wished to strengthen. For example – creating shared visions of change, capacity to influence higher-level institutions, and capacity to manage novel business and governance models.

Building general resilience across towns, regions and suburbs will depend on local stakeholders finding ways to shape the nature and direction of change.

Lesson 2:

Regardless of context, building local resilience to climate extremes will rely on the same building blocks and face similar challenges.

This does not mean the same solution will work in multiple locations but that context-specific strategies can be achieved using a small number of design principles and approaches. In particular:

- using or reconfiguring local assets to increase the diversity of key functions
- creating new partnerships to support transfer of knowledge and improve collective decision-making
- building social cohesion to harness and celebrate local strengths
- increasing influence over key functions that are outside community control
- creating institutions for sharing ownership and governance of critical assets.

Building local resilience through these strategies will confront many of the same challenges affecting state and local government-led climate adaptation. However, a number of barriers are particularly influential at the local level - poor social cohesion, scepticism about change, absence of strong, community-agency institutions, and limited community experience driving development projects. These barriers weaken the formation of a common purpose, reduce community capacity to influence external stakeholders and undermine the formation of new institutions or communities of practice.

Lesson 3:

Building local resilience will rewrite traditional community and agency roles, change their sense of purpose and redesign positions of authority.

The visions created in this project show a future where power, resources and responsibility has devolved substantially from state to local government and local government to community. Currently, key actors lack compelling incentives for this change. A strong tension exists within and between community and local government about the nature of innovation required. On one hand, agencies recognise building resilience is fundamentally a local issue. On the other, local governments, regional-based agencies and communities are sceptical that state and federal agencies are happy to use the language of local resilience because it sheds responsibility. Doubt exists whether adequate allocation of resources will follow. State agencies are also challenged by this idea, given their current role and responsibility as providers of expertise in emergency management. At an agency level, there is also significant doubt whether local stakeholders have the capacity to handle more responsibility for disaster management. This mistrust emphasises the absence of institutions that bridge decision-making groups at a community level with local and state government agencies.

Lesson 4:

Scenario-based methods can help diverse stakeholders understand future risks, develop goals for building local resilience, and identify barriers to change.

Key strengths of the method developed in this project include an ability to help people across community and government to:

- avoid reliance on quantitative estimates of disaster event probabilities
- explore challenging risks in a safe and positive way
- expose and test assumptions about current and possible mitigation strategies
- interrogate complex risk-related issues from multiple angles in a relatively short period of time
- identify and prioritise shared values and goals
- come to terms with non-linear change and what it could involve.

Outcomes suggest the method can also help test relationships, lines of responsibility and expectations between government agencies and between government and community.

More generally, these findings demonstrate the benefits of prototyping or ‘mocking-up’ radical ideas for change. This approach allows people to experiment conceptually with the implications - identifying potential problems and areas for deeper investigation.

4.2 Recommendations

This project has identified a number of leverage points to help build local resilience to climate extremes. These have been separated into recommendations for state and local level government. While they are directed at the Victorian context, we believe most are applicable across Australia.

State government

- Integrate the use of extreme weather scenarios into the Emergency Management Manual Victoria (EMMV). We recommend the creation of state and regional scale scenarios every 3-5 years. Scenarios would depict plausible high impact, low frequency hazards involving multiple concurrent threats (natural hazards, infrastructure failures and resource constraints). Agencies required to use the EMMV would apply these scenarios to 'stress-test' capability, identify vulnerabilities (eg. in Township Protection Plans and Municipal Emergency Management Plans) and explore areas for improving partnerships between stakeholders. Scenarios would be open for public review and changed periodically to reflect different aspects of each region and updates in knowledge. We may learn from the US Dept. Homeland Security who uses scenarios for testing response capacity of state and municipal agencies [35].
- Avoid templates and criteria that prescribe what towns or communities 'must have' in order to 'be' resilient.
- Experiment with different inter-agency and agency-community structures tasked with guiding and implementing disaster mitigation strategies. Strong partnerships with willing local governments will be essential.
- Update existing emergency management guideline documents to explain the deficiencies of probabilistic risk estimates for future weather extremes. Include guidance on the use of alternative methods to explore and prepare for low probability, high impact risks.
- Review financial and material support for natural disaster and climate related community engagement by state and local governments. Prioritise processes that build community cohesion and transfer organisational and governance capacity to community groups. Limit use of educational emergency management programs unless they involve a strong practical or experiential methodology.
- In all official public documents using the term resilience, define or reference what it means. Avoid definitions of resilience in which the return to pre-disaster conditions is a primary goal.
- Support action research and community development programs that enable community-led social innovations addressing local resilience.

Local government

- Continue existing efforts to integrate and share approaches and resources for climate change adaptation.
- In programs supporting local resilience, target vulnerabilities that arise where extreme weather threatens critical assets not under local government or community influence. Support communities to harness and reorganise existing community strengths in novel ways and increase community control over critical functions.
- Build an open-source, online resource platform to compile case studies, tools and details of business and governance models used to address community vulnerability (worldwide). Place a strong emphasis on collecting proven models for collaborative planning and decision-making and case studies involving the use of localised resource and knowledge commons.
- Pilot the process developed for this project with the explicit aim to implement a small number of community visions (or components). Use this to experiment with cross-scale institutions and build local capacity. The process can be framed in way that keeps ambitions and costs grounded in reality. The full range of visions developed in this project (www.ecoinnovationlab.com/project/visions-of-resilience/) included projects that fit these criteria.
- Establish programs to monitor community cohesion and identify factors undermining it.
- Encourage state government to incorporate regional scenarios into emergency management guidelines for regional and local agencies. Meanwhile, work with adjacent councils to develop extreme weather scenarios over a 25 year time period. Apply these to explore weaknesses in local communities and in existing organisational responsibilities and practices.

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Visions credits

Creswick Resilience Centre (pg. 34):
Diana Pardo, 2013

Embracing the Flood (pg. 35):
Diana Pardo, 2013

Creswick Water Bank (pg. 36):
Diana Pardo, 2013

Creswick Timber Manufactory (pg. 37):
Diana Pardo, 2013

Creswick Agri-Hub (pg. 38):
Jessica Bird, 2013

Anglesea Eco-Tourism Institute (pg. 39):
Andrew van der Merwe, 2012

Anglesea Market Garden and Harvest Festival (pg. 40):
Damien Armellin, 2012

Anglesea Lake (pg. 41):
Damien Armellin, 2012

Inland Rapid Transit System (pg. 42):
Andrew van der Merwe (left), Jessica Bird (right), 2012

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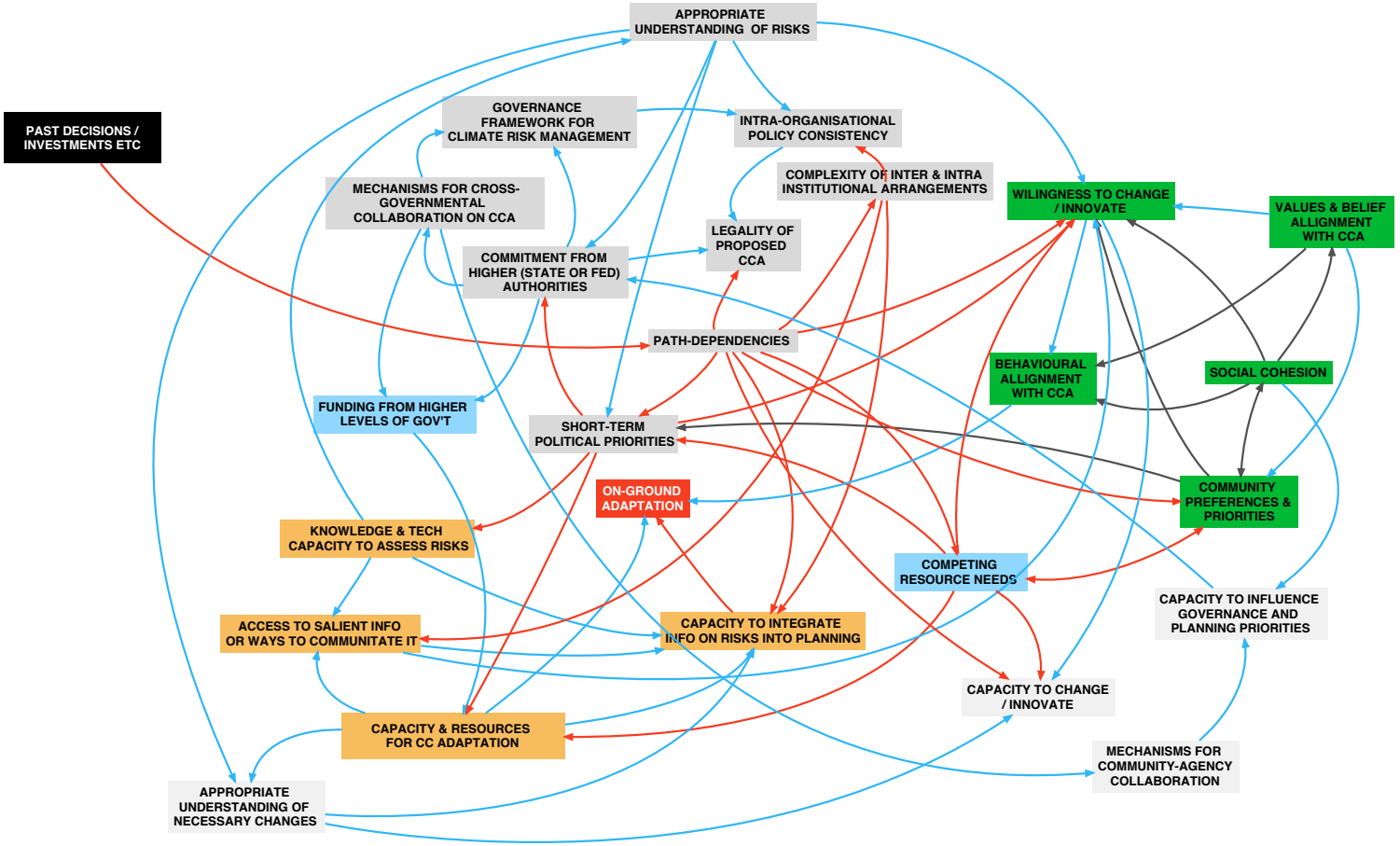
APPENDICES

Appendix 1

Barriers to climate change adaptation (systems of influence)



Appendix 2

List of interviewees

Names and positions have been removed to provide anonymity. Primary relevant areas of responsibility and organisation are provided.

#1 - Sustainability and climate change adaptation, City of Port Phillip

#2 - Sustainability and climate change adaptation, Melbourne City Council

#3 - Climate change adaptation, Municipal Association of Victoria

#4 - Community engagement, CFA (Vic)

#5 - Community engagement, CFA (Vic)

#6 - Community engagement, CFA (Vic)

#7 - Community engagement, CFA (Vic)

#8 - Community engagement, SES (Vic)

#9 - Climate change adaptation policy, DSE (now DEPI)

#10 - Emergency management, Surf Coast Shire

#11 - Sustainability, Surf Coast Shire

#12 - Sustainability, City of Frankston

#13 - Councillor, Hepburn Shire Council

23 interviews were also conducted with residents of Anglesea and Creswick.

Appendix 3

Selected survey questions

Q1. The following statements offer different perspectives on emergency management and climate change adaptation. Indicate how much you agree or disagree with each one.

Note these are just statements of opinion, there are no right or wrong answers.

A. The frequency and intensity of extreme weather events will increase over the next 50 years

B. Being able to determine the frequency and size of future extreme weather events with reasonable accuracy is a prerequisite for adequate planning and preparation.

C. As a general rule, most organisations responsible for emergency management place more emphasis and resources on responding to and recovering from natural disasters than planning to avoid future events.

D. Most organisations responsible for emergency management rarely if ever plan for extreme weather events larger than those defined by a 1 in 100 year probability.

E. As a general rule, most organisations (responsible for emergency planning or climate change adaptation) emphasise short term (5-15 year) asset protection strategies over alternatives that aim to avoid future impacts over a longer term (30-50).

F. I feel confident that most relevant agencies have a good understanding of the types of impacts society will face from climate change

G. Many local impacts of climate change will never be predicted with any certainty

H. As a general rule, relevant agencies and organisations understand the types of changes needed for society to be more resilient to climate change impacts.

I. Climate change will drive an increase in the general frequency and intensity of extreme weather events over the next 50 years.

J. When planning for the possibility of future disasters, extrapolating from historical events is critical for determining the likely frequency and size of future events

K. Most of the risks posed by future extreme weather events can be predicted using methods and knowledge currently available.

Q2. As a general rule how should organisations respond to/ plan for the possibility of increasing extreme weather impacts due to climate change? (Of the following statements, which best reflects your personal opinion) Of the following statements, which most reflects how the organisation you work in deals with any future risks posed by climate change amplified extreme weather?

- Don't change anything; its not a priority
- Don't change anything; the risks are negligible.
- Strengthen current management and operating practices and respond to impacts as they arise.
- Extrapolate from historical trends to predict future conditions and prepare for these.
- Improve response and recovery capacity
- The most important thing is to make sure we can return things to how they were before any extreme event.
- Ask experts to determine the most likely impacts (eg. with quantitative models) and plan for these.
- Consider a range of possible future conditions (eg. from best to worst) and prepare for something in the middle.
- Consider the worst plausible set of future conditions and prepare for this scenario.
- Consider a range of possible conditions and look for strategies that work in most cases, wait for more clarity on the rest.

Q3. Which of the following statements do you agree with most?

In 50 years at the community level:

- Climate change will have had negligible impact on environmental conditions
- Climate change will have had some minor impacts on environmental conditions. Relevant agencies probably have a good understanding of what these impacts will be
- Climate change will have had major impacts on environmental conditions. Relevant agencies probably have a good understanding of what these impacts will be
- Climate change will have had some minor impacts on environmental conditions.

Relevant agencies probably don't have a good understanding of what these impacts will be

- Climate change will have had major impacts on environmental conditions. Relevant agencies probably don't have a good understanding of what these impacts will be

Q4. Compared to your current everyday conditions, if the earth warmed 4 degrees over the next century, how different do you imagine society might be as a result?

- Not much - It would operate in much the same way
- Somewhat different - The way everyone would go about things would have to adjust
- Very different - Some things would be unrecognisable
- Radically different – Society would operate by different rules and many aspects would be hard to recognise
- No idea – I find it hard to imagine what it might be like

Q5. In your opinion, how long will it take before climate change impacts have caused substantial changes to the way most organisations function?

NB: By 'substantial' we mean many planning and day-to-day operational decisions within organsations are shaped by impacts or the need to avoid those impacts. eg, where funding is allocated, what programs are run, how priorities are made etc.

- Never
- 0 its already happening
- 1-10 years
- 10-20 years
- 20-40 years
- 40-60 years
- 60-100 years
- More than 100 years

Q6. From the five following statements, which reflects the most valuable role community could play in building local resilience to future extreme weather events?

Which of the following five community roles best reflects the practical approach of the organisation/s you work with?

- Doing nothing – no change necessary
- Provide direct input into the exploration, selection and design of local adaptation strategies and projects.
- Trust relevant agencies (eg. local government, CFA, SES etc) to develop and implement necessary adaptation strategies. Implement any suggested actions at the household level (think fire protection plans).
- Provide comment on adaptation strategies developed by relevant experts (akin to current opportunities for community input into planning strategies).
- Respond as each individual or household sees fit, if and when impacts occur.
- Anything missing here? Comments? (please specify)

Q7. To what degree do you agree or disagree with the following statements?

A. Broadly speaking, the general community is unaware of the severity of likely climate impacts

B. Most local or regional government organisations responsible for emergency management and climate change adaptation are highly sensitive when communicating to the public about possible climate change impacts. Sometimes, this can mean withholding, selectively releasing or delaying the release of information about possible local impacts.

C. As a general rule, the community is not well equipped to have a measured debate about the likely impacts of climate change and/or possible adaptation options

D. As a general rule, most relevant government agencies are not well equipped (don't have the skills or resources) to cultivate measured community debate about the likely impacts of climate change and/or possible adaptation options.

E. As a general rule, there is a disconnect between the level of risk posed by climate change and the level of preparedness and risk management within relevant agencies?

Appendix 4

Scenario stories for visioning workshop - Creswick

What Climate Change means to Creswick residents in 2037.

Dr Greg Burdett (63)
Regional Health Worker

Greg notices the main impacts of climate change in the knock on effects of higher temperatures and more intense drought.

Increased frequency and intensity of heatwaves (consecutive days >35C) has put a major stress on the Shire's elderly and very young - Greg's main clients.

Despite adding extra staff every summer, the number of call-outs during heat waves is often beyond what Greg's colleagues can provide. Heatwave fatalities also are markedly higher than 15 years ago. This exacerbated drought years when persistent dusty conditions cause widespread respiratory problems in the old and young. Near the tail of the 2023-30 drought, dust problems also saw the primary schools closed frequently in late summer and early autumn. It's not unusual for the dust to keep students inside.

Increasing use of remote monitoring technologies makes checking on clients easier but 'Extreme' and 'Code Red' fire days are an annual occurrence. These make moving around the area a problem. Services that require travelling are increasingly weather dependent and are often cancelled due to fire risk over summer. As a result, the health services are facing litigation for 'denial of service'.

While drought–related stress has always been a problem, Greg notices more people with traumatic stress – even just heavy rains and smoke that trigger memories of past events. However, people respond to higher risk in different ways and some are increasingly blasé. For some people, the constant smell of smoke seems to be making them less concerned. Despite the increase in fires, the number of fire reports is falling. After years of Creswick being 'ever-ready' the CFA is concerned about a growing 'cry-wolf' mentality.

Greg wonders how people will react and what people will do when the next 'big one' comes.

Nearing retirement, Greg is looking forward to spending more time in the garden. Winter and spring are increasingly warm and mild.

Sunny Winters (52)
Site Manager – ZeroGen

Sunny moved to Creswick to manage a Solar Farm near Ballarat in 2016. After living in the area for 21 years she has experienced impacts from climate change in a number of ways.

More severe, short-intensity spring, storms are a problem for ZeroGen. High winds and large hail events have caused major damage – wrecking PV arrays and driving a constant increase in insurance premiums. During the last long drought, dust was also a major problem affecting energy output in summer – just when it's needed most. As a result, ZeroGen has been wrongly blamed for blackouts during summer heatwaves, despite the problem stemming from aging distribution infrastructure.

As a hiker and bird watcher, Sunny has noticed the wild flowers are out a month earlier in spring and there's been a big drop in the number of small native birds in the area. Even after a few mild years, the bird numbers haven't returned.

Having moved from Darwin, Sunny finds the water restrictions (3 out of 4 years) a major challenge and avoids the reticulated water; its quality varies so much these days. However, she also struggles to keep her water tanks clean meaning bottled water is still popular.

While used to the constant burning off along the road-verges,

Sunny does wonder about the security of water supplies in the event of a fire. CFA extractions from mains supply during burn-offs make a big difference to water pressure in her home.

Lucy and Luke Spargo (27 & 38)
Electrician and Horticulturalist

The Spargo's have two properties, an electrical retail store in town and their family home on an 80 acre plot near Dean. For the Spargo's, juggling weather extremes is par for the course.

During mild seasons, their mix of garlic and sugar beet now grow faster than they used

to. Their bio-energy crop also does better with fewer frosts. Sowing and harvesting are also earlier. Mild seasons are less frequent but instability in global food production means commodity prices are consistently high. However, the good times need to cover for longer periods of uncertainty.

Volatile oil prices have pushed up the cost of fertiliser and running machinery to the point where some good years deliver only marginal returns.

Water security is a big issue. Rainfall is down by 20% - mostly over winter and spring. Higher evaporation and soil temperatures also mean runoff to dams and infiltration to groundwater is down almost half. When it does rain, it pours. Spring and summer rains are much stronger - meaning erosion and hail damage are big problems.

With a wholesale shift from the ‘oil’ to ‘electrical’ economy, Lucy’s electrical service store hasn’t seen better days. But its location on low-lying ground in Creswick is an issue. High rainfall events are a frequent problem. The 2010/11 floods have been repeated twice and there have been at least five other close calls. The levee banks put in place have delivered mixed results – reducing flood risk from high frequency small storms but trapping the water and increasing damage during larger events. Insurance premiums reflect this new risk environment.

Appendix 5

Scenario stories for visioning workshop - Anglesea

What Climate Change means to Anglesea residents in 2037.

Lynn Wilder (25)
Professional surfer

Interviewer: *Can you tell me a bit about who you are and your relationship to Anglesea?*

Lynn: I'm Lee Wilder, I'm 25, I'm one of the lucky big wave surfers still making a living. I was born in Anglesea and I travel a lot for work but its definitely home. I come back here whenever I can.

Interviewer: *What is important to you about Anglesea?*

Lynn: Three things - Being able to afford to live in Anglesea and bring up kids here. The beaches - that they stay wild and don't become a south coast Brisvegas, and jobs - that we ensure there's a way for locals to make a living here. It's easy for me because I make my money touring but a lot of people here are doing it tough.

Interviewer: *How is your day-to-day life affected by change climate and how have you noticed changes in the area as a result?*

Lynn: Well I don't know if its true but they say its just warmer most of the time. The water is definitely warmer, and that means more tourists are coming down. Everytime I come back from a tour it seems like the beaches are more packed - there's more fighting for waves, competition for beach space all of that. There's a real breakdown in culture too, with the beach bars that've opened. And there's definitely less respect for the beaches as a result. So there's more pressure on the surf club with all the extra people but there's also less jobs and fewer families staying down here, so that means there's fewer nippers to keep an eye out. It's the same in the SES and the CFA - apparently there's been a steady rise in call-outs in the past 10-15 years but fewer younger people as well.

Interviewer: *Have you seen any changes in the water as a result of climate change?*

Lynn: Jellyfish. I don't know why, but they say jellyfish are something to do with climate change. You'd hardly believe it but in the last five or so years they've become a real problem. And that doesn't just go for here. I see it in beaches all around the world. People are getting stung all the time and some beaches you just don't go to now. What else…. the breaks are different. Not heaps but they're definitely different. I've never surfed the low-tide reef breaks that my father did. Quite a few of the ones I rode as a kid on low tide now only work in big swells for example. It doesn't phase me much but all the oldies are grumbling about the take-offs all being different. The beach breaks have changed too, but they always did.

Interviewer: *What have you noticed about the more extreme impacts of climate change?*

Lynn: Well I guess the big one is the storms – the beaches are constantly washed out by the big tides, and that means there's lots of people calling for the beaches to be concreted and sandbagged and groins and whatever. I don't know if its true but it seems like there's more sharks around. Particularly after the big storms. For example after the 2028 and 2029 floods when a lot of junk got swept out to sea, we had a few white pointers hanging around for months. Now everytime there's a big storm, they're back. On the other hand its not the extremes so much, as the way everything seems to happen at the same time. Like take summer. I always head off – but my mates who live down here dread it – they hate it.

First you've got the tourists, they've always been a problem but there's just crazy numbers now – and they're everywhere. They're getting heatstroke cos its hotter, so the nippers are flat out. Then they can't handle it down here without an air-conditioner. (You can't rent out a place if it doesn't have a good aircon system anymore.) So then you've got all the aircons going in the heat. Everyone's got their blinds drawn so no one's keeping an eye on the scrub in case there's a fire - and everyone's from the city so they don't think about fires anyway. They just wouldn't know what to do. Then cos of the aircons going the town blacks out all the time. So all water pumps cut out, the old folks start to stress and they have to evacuate the retirement villages to Geelong. I hate to think what would happen if you added a fire to the mix- and it'll happen. And then they use so much water! So the towns' gotta ration water most of the year for the tourist season – although the seasons' getting longer so that's harder to do. Its those kind of things that make a huge difference, not so much the big events.

Interviewer: *When you think about the future of the region and Anglesea in particular, what are your biggest concerns?*

Lynn: The fact we're gonna see six meters of

sea rise. I know its going to be slow but they say that now that the Greenland ice sheet is going and there's nothing we can do, we're gonna have an extra foot or two every 50 years. The beaches wont be the same at all. Maybe I wont see it but if I have kids, they will for sure. What's that mean for the road and the tourists? What's that mean for the beaches? Will they all disappear or can they adapt? Will the beaches still bring the tourists down or will they go somewhere else. I don't know, but everythings gonna change.

The cost of living's another thing. Its ok for me cos I've got pretty goodsponsorship but most of my friends have all left Anglesea. The tourists have jacked up the house prices even more and if you don't have a beach bar, or a café, or a shop, there's not much you can do for a living down here. I guess the other things would be the trashy Beach bars – they're all up the east coast beaches, but we'd never seen them on the south coast till ten years ago, and now they're like a rash. And Anglesea is under heaps of pressure to open up its beaches more and more to commercial interests. If that happens Anglesea will lose its soul – that's what I reckon.

Interviewer: *And what are your biggest hopes for the future?*

Lynn: Well, I guess it's that there can be some balance found with all the tourists, house prices and pressure on the beaches. If that can be managed, Anglesea has a good future. 6 meters of sea rise aside! Maybe I won't need to go anywhere to get 40ft waves, haha! Those storms mean we get really world-class big swells about once a year now. Maybe they'll get bigger. Some of the outer reefs further down the coast are attracting more attention cos of the bigger swells. So that'd be good. Pe'ahi (Jaws) can come to me!

Jim Li (42)
Tourism operator

Drivers of change:
- Sea level rise of 25cm
- Wildfires and storms
- Heatwaves
- Drought
- Insurance
- Changing nature of tourists

Interviewer: *Tell us a bit about who you are and your relationship with Anglesea?*

Jim: I'm Jim Li. I'm a father of two girls and a tourism operator of 10 years. I'm a resident of Anglesea - I've been here for 15 years. And I'm passionate about Anglesea – It's a great small town with great people and a giving community.

Interviewer: *And what is important to you?*

Jim: My business, and being able to show tourists that come here how beautiful the place is. Freedom to run my business how I want – without too much interference from the regulators. The coastline – this beautiful part of Australia, and yeah - bringing up my kids.

Interviewer: *How has your day-to-day life been affected by climate change?*

Jim: Climate change. Well look – almost everything. I mean at least indirectly. Heatwaves for example. There's about a serious heatwave every year with at least one day of catastrophic fire risk. By a serious heatwave I mean it causes health problems for the old people in town, it forces me to cancel or change any tour I've got planned further down the coast. Other activities go to ground and basically, we just sit around trying to keep sane and keep our eyes on the horizon for smoke and hope we don't get a lightening storm afterwards. Mind you, we're in constant fear of fires – even in spring and autumn. Unless of course we get one of those big wet summers when the river divides the town for a days. We used to get around 9 days over 30°C, now we get close to 15 and I can count on having at least five days over 35°C when it used to be only 2 or 3. (A heatwave is 3 or more consecutive days over 35°C.)

The seasons have changed too. The best time to take tourists is in spring and autumn. There's less risk of fires and heatwaves. Although there's definitely the risk of bigger storms in spring. Other things have changed too. We've now got the wildflower show a month earlier because it gets warmer quicker than it used to.

There's just a lot more risk to account for. My insurance bills for my home and business have more than doubled what they used to be a decade ago. Everywhere I go I have to be so careful. I've got tourists with heat stroke almost every year – particularly with the fact that one in three is overweight and so many people are just bloody uncoordinated. I guess they spend their whole time in a city and then want to get a dose of the bush. The lack of water is another issue. I'll always carry twice

as much water than when I started doing this. The tanks and the toilets on the camp-sites are always dry and if there is water there in summer, the possums are pretty good at finding a way in and drowning.

Interviewer: *What have you noticed about the more extreme impacts of climate change?*

Jim: I'm not sure if its climate change but the severity of the storms seems to change the coastline every couple of years. Road washouts are pretty regular and we've lost about 25m of those sandy cliffs at a lot of points2. (SKM 2012. Coastal climate change vulnerability and adaptation. Great Ocean Road Coast Committee.) There were two years about five and 15 years back when the road to Lorne was basically impassable because of constant slips, erosion and flooding. With all the maintenance, many people heading from Melbourne to Lorne went the top way. A few of the smaller towns further along got really hammered and quite a few people moved on that year.

I probably cancel or completely change five trips a summer because of the fire risk. I'm afraid I'll get a bus caught along the road and we'll all get cooked like that guide from Lorne did six years ago – and that was in November. The storms are pretty extreme too. While we seem to get less of them, the ones we get are pretty nasty. They wash out the coast and come in much higher than they used to and more of the walking track's exposed because of it. That's how all those hikers got washed away doing the coastal walk. The caravan park has a real problem too. They're losing protection from the dunes and the river seems to take over more and more of that site on high tides. I'd be worried about the next big storm season if I was running that.

Interviewer: *When you think about the future of the region and Anglesea in particular, what are your major concerns?*

Jim: Camp and tour operators losing their business due to rising liabilities. Not being able to operate because my insurance costs are too much. I'd hate to have to switch business because of that and then see one of those bigger tour franchises move in. Getting a tour caught in a wildfire. Not being able to run tours down the coast over January and February. I'm worried about my daughters' future. As oil prices continue to sky-rocket it's almost impossible to drive them around to sports and activities like you used to. A lot more planning and saving has to happen before we can take a family holiday. On the upside, they learn a lot about fire/flood/storm safety at school, and are prepared and know what to do if there's an emergency. What is life going to be like for them as they grow up and have families of their own?

Interviewer: *And what are your biggest hopes?*

Jim: More steady business – people are beginning to take more trips in spring and autumn. As long as insurance costs don't get too high, I think the business will do better. Local knowledge is key to managing the risks, so I reckon it'll mean us small operators might do better.

Trevor Lindello (68)
Viticulturist

Drivers:
- Heatwaves
- Fires
- Drought
- Cost of operation
- Ageing demographic
- Low property prices

Interviewer: *Thanks for making the time to do this Trevor. First of all can you tell us a bit about who you are and your relationship with Anglesea?*

Trevor: I'm a trying to retire viticulturist. I have a vineyard West of Bellbrae and one down near Apollo Bay. But I'm close to seventy now and I've been trying to sell-up for about seven years but I can't because of the drought. I've got a place in Anglesea and I've been coming here since my parents' bought a place in the 1980's. As soon as I can leave the vineyards I'll be in Anglesea permanently.

Interviewer: *And What is important to you, I'm particularly interested in Anglesea and the wider region?*

Trevor: The size of the place, that is a small place that hasn't grown much - Anglesea I mean, and the fact I've got most of my friends here. The beach of course. The birds (though there's less now), and the wild flowers - I'm spending more and more time on the heath.

Interviewer: *Can you tell me how your day-to-day life is affected by climate change?*

Trevor: Less rain and more rain would be a start. And I know because I keep good

records. We used to get about 230 days without rain and now its around 240. And since 2030, we haven't had any rain of value. I know it's a lot of natural variability but that's a real worry - especially with the uncertainty about the aquifers. My extraction license has been halted about five times over the last 20 years and it seems to jump up in cost every few years.

From the perspective of my business, the uncertainty in the weather basically made me chose between supplying grapes to the big producers and being a specialist. I chose the later and basically shifted to being a low volume boutique winemaker. I don't rely on irrigation any more – except to get my grapes through the worst of the dry. It's basically too expensive. But its not all bad. Since I changed all my varieties I actually get a really good quality wine with the lack of water - and it sells at a premium. The mildew is definitely worse though. Its actually not as common as it was 30 years ago but when the vines do get hit – in one of those big wet summers - there's not much we can do. It'll take hold, no matter how much you spray, and take the lot.

Interviewer: *Any thing else?*

Trevor: Well I guess when I think of my friends - climate change has affected everyone's health. With the long dry and the fires, there's plenty of people with lung problems. The cost of a bed in a local residential care facility has gone right up too. They say it's the fire risk and all the extra equipment they need for the heat and for evacuations. They need to have some pretty elaborate evacuation plans.

What else – oh, the flower show, we've had to move that a month earlier because that's when everything's blooming now. There's been lots of changes in the heath.

I**nterviewer:** *What have you been affected by the more extreme impacts of climate change?*

Trevor: Between the hail-storms and heatwaves stripping my vines, the smoke taint from the bushfires and the constant dry. Plus the power outages, I'd say I'm constantly juggling the impact of the extremes. One of the impacts is just the cost of all the equipment you need to deal with those threats. You can install an underground reservoir, automate shading systems for the heat and I've got soil sensors linked to weather forecasts for highly targeted irrigation - but it all costs. And it's all stop-gap. You can think you've got it covered and then something else will come along – like a hail-storm that'll turn your shading system to rags. It's easy for the growers in the Coonawarra because they've got the scale, but the uncertainty kills us smaller guys.

I guess its not climate change – or maybe it is, but there's always fire. You can smell it even if you can't see it. Everyone thinks about it. With the peat in the heath going up every five to seven or so years with the lightening storms, it's ever present. I guess the big question though is when the mine will go up in smoke and what we'll do then – we just don't have the water like we used to.

The extremes are all linked too. Its like dominoes from one thing to the next - we don't seem to have the buffer like we used to. So, for example - the last big fire cut the power supply lines east and west of the town, so then we were blacked out for a bit over a week, and when that happens in the heat – well, then you see the frail really struggle. Its hard to pin down the causes, but people that weren't hit by the fire died in the heat. I guess it's the stress of everything. And then you've got the drought like now.

Like I said, it's the combination of things that make it so difficult. You think you've made it through a bad summer all right and then your mate's ringing up asking if he can stay in your shed because his house on the river got taken in a freak storm. It's a drain on the town.

Interviewer: *When you think about the future of the region and Anglesea in particular, what are your main concerns?*

Trevor: I guess my big one is that the dry's here to stay. That the aquifers won't fill and that we'll need to store most of the water we use in a year. It was hard to imagine after the big wet of 2010 but now its what people expect. Its not just producers and the town that'll be affected, its harder to imagine how the heath can cope with this level of dry and the constant burning. Its changing that's for sure. The birds are leaving – or dying I'm not sure. Since 2033, there's been fewer and fewer every year – except the crows of course – plenty of them.

After that I guess it's the fear that the government's going to draw another line in the sand and say they can't protect properties for flood or erosion damage. I'm only a bit higher than the first line of houses along the river that get hit in a big downpour.

Apart from those, I guess it's just the concern that the local health services are pretty stretched with all the people retiring in Anglesea now. I guess, they're like me in that I feel the heat more than I used to. And its hard to go into the centre of town in summer, its just too hot. I know there's a lot of pressure for medics and beds over summer too. Lots of my friends my age have moved to Geelong.

Interviewer: *What are your biggest hopes?*

Trevor: That it'll rain again and stabilise a little bit. If that happens I'll be able to get off a good vintage and sell my business. If that happens the birds and the flowers might come back for a bit too.

I guess my other hope is that the strength of the community will hold. It's better than most places, but everyone's stretched and we're all operating in our own little worlds. We need to work things out as a town – but I think we can if we want to.

Appendix 6

Organisations participating in the agency workshops

Anglesea

Dept. Transport Planning and Local Infrastructure Geelong

Country Fire Authority

Parks Victoria

State Emergency Services

Surf Coast Shire

The University of Melbourne

LaTrobe University

VicRoads

Angair

Grovedale Community House

Anglesea Business and Development Committee

Melbourne

Country Fire Authority

Emergency Services Telecommunications Authority

Dept. Environment and Primary Industries

Fire Services Commissioner

Commissioner for Environmental Sustainability

Red Cross

The University of Melbourne

Hepburn Shire Council

Office of the Emergency Services Commissioner (OESC)

State Emergency Services

Creswick

Department of State Development, Business and Innovation

Dept. Environment and Primary Industries

Country Fire Authority

State Emergency Services

Hepburn Shire Council

Goulbourn-Murray Water

The University of Melbourne

The University of Ballarat

State Emergency Services

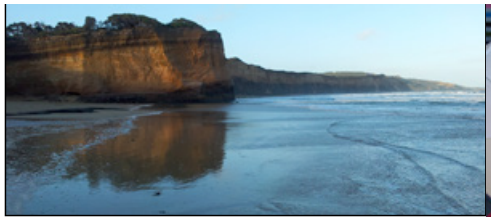
Hepburn Localisation network

Pavilion Arts

Committee for Creswick

Appendix 7

Online engagement report - as of 9 April, 2013.



[anglesea2037]
Online Engagement

[Summary of project]

The 'Anglesea 2037' project is the co-development of an online platform for the Victorian Eco Innovation Lab's project exploring how the Anglesea community can adapt to extreme climate events. The online platform ran from October 2012 –March 2013) and is still live (and getting consistent traffic).

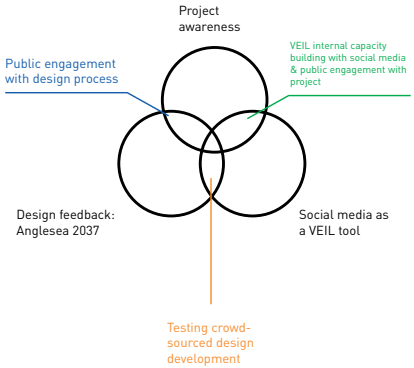
The major goals of the project were to:

- Encourage community feedback to 'Anglesea 2037: Visions of Resilience' design scenarios from Anglesea community members

- Create awareness of the project through social media. Set up a blog and Facebook page for Anglesea 2037: Visions of Resilience

- Provide up to date information about the project

- Analyse how the social media platforms develop in a wider context of exploring opportunity to develop online platforms as ongoing engagement for VEIL projects.



[Outcomes]

- A specific tailored digital platform and forum for discussion of the VEIL project

- Ongoing engagement with various social media users on different elements of the project

- Capacity building with VEIL staff to use social media as a tool

- Creating a public profile for the project and go to point for stakeholders and the general public

- Feedback to specifics of the visions

[Lessons learnt]

- Online engagement platforms receive various responses, many of which we cannot monitor the type of reaction (only the quantity of hits). Therefore when developing the engagement strategy think about the visitor, the follower, the endorser, the contributor and the champion.

- Targeting a specific geographical area takes integrated physical and digital solutions, that are context appropriate. Develop these in tandem.

- Digital means global: Think about how the project will engage with local users and those on the other side of the globe.

- Providing small tidbits on the approach, information updates, related news information that give people insight into the process and accessibility to bite size information. This sort of transparency is good for developing momentum.

[Key points of interest]

1. The amount of active feedback (contributors/champions) to the design scenarios was less than expected however the amount of passive feedback (visitors/followers/likers) was greater than expected. The platform had greater functionality as a communication tool and the visions did not spark an active response.
2. The feedback was not particularly useful for design revisions to the scenarios. As a crowd-sourced design tool this needs some revision to incorporate productive comments for ongoing design development.
3. The feedback was interesting in terms of the readiness of community members to such ideas
4. For the purposes of an online community engagement strategy this is not accessible enough for the general public to engage. The level of design thinking meant the scenarios were more appropriate for a design audience.
5. The spread of online engagement was particularly large and from many countries. Therefore there are future opportunities to develop the tool as a global-local dialogue. That is, bringing international knowledge to a local context + connecting localised projects within a global network
6. The digital engagement is an extension of other engagement with the community. Without community members actively engagement with the site and focusing on existing community groups and institutions we are limited in our capacity to develop and encourage a physically localized response to the platform.
7. Social marketing worked really well to create interest in the site and develop the audience, use this as a tool to launch the site (with very targeted key word profiling).

Project reach

Design feedback:
Anglesea 2037

Social media
as a VEIL tool

[Statistics]

2793 blog views
126 Facebook Page Likes

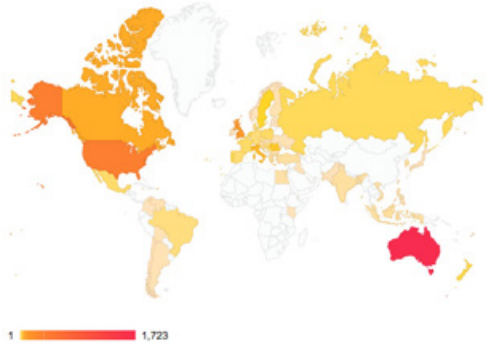
Top pages:
1. Homepage
2. Underground house
3.Great Ocean Road Resilience Zone
4. Visions
5. Inland Rapid Transport

68 comments

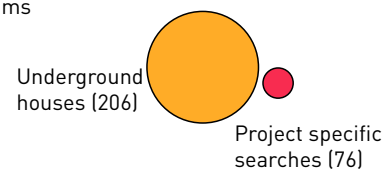
Most commented:
1. Underground house
2. Great Ocean Road Resilience Zone
3. Inland Rapid Transport

Visitors from 70 countries

Country	Views
Australia	1,723
United States	363
United Kingdom	96
Canada	59
Italy	38
Romania	37
Sweden	33
New Zealand	24
Portugal	22
Russian Federa...	21
Netherlands	21
France	19
Poland	19
Mexico	18
Serbia	16
Spain	16
Hungary	15
Germany	15
Brazil	14
Denmark	13
Czech Republic	11
Slovenia	10
Puerto Rico	10
Israel	10



Most popular
search items



[In future]

1. In future projects engage earlier in the design process. Launch the digital platform at the start of the project as design conjectures for the public to build upon (then add a building block when necessary). Word using positive questions
    - Example 1 – How can we develop local food production within the town of Anglesea?
    - Example 2 - How can we create a car free zone along the Great Ocean Road?
1. The design scenarios were very resolved and specific when they went public – there were no 'gaps' in them that people could bring their own create knowledge to without being an expert
2. Create exercises that ask for specific creative/research responses according to the point of the project. Example - During early phases ask for specific examples.
3. What projects do you know of that are good examples of local food production?
4. Collect user experiences/personas > Use these insights as a starting process for workshops and design concept stage
5. In future develop drawings that are context specific (photo collages of before and after; user scenarios etc.). Test these images on the public before use in wider engagement.
6. Collaborate with primary/early high school kids to develop the imagery of the visions
7. Include an online survey with clearly structured responses to catch those people who want to engage however do not want to publically
8. The language was very dense and with a level of expertise > for the purpose of community engagement this would need to be delivered in a much more casual and accessible manner.
9. Set up a forum targeting specialists to run parallel to general public engagement.

Appendix 8

Analysis of selected visions

Resilience principles


Diversity


Redundancy


Modularity


Enhanced feedback


Adaptive capacity


Impact avoidance

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Creswick Resilience Centre	Emergency Safe House	No disaster safe-house	Reduces consequence of failure	
	Commons-based repository for storage of resources needed for localised response and recovery	Limited / delayed access to resources for recovery	Increases response capacity and builds community cohesion	
	A audio-visual memory-bank of stories and experiences related to people dealing with extreme weather	Collective memory of natural disasters and lessons learnt – reduces over time	Increases community capacity to prepare and respond to events based on its access to a collective memory	
	Exchange program linking to other resilience centres in other towns and communities	Limited / no capacity to learn from distant disasters	Enables sharing of knowledge and exchange of new ideas	
	Real-time visual feedback on health of community assets	Limited capacity for locals to understand health of systems they depend on	Builds common understanding of shared strengths and weaknesses and supports strategic collaborative action	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Relocation and embracing the flood	Flood-risk businesses relocated to Railway Precinct	On-going flood risk	Relocation to the railway precinct helps ease transition to rail freight and maintains a connection with other towns	
		Town gets split by floods – assets and businesses affected		
	Re-zone creek flats to food growing and recreation	Community disconnection from natural environment	Creek is incorporated into town's identity and awareness	
		Food supply dependent on external sources and road freight	Diversifies and increases community control of food supply	
	Focuses town around Railway as key transport node	High dependence on road transport exposes town to energy price volatility	Increases use of rail for commuting and freight	
			Minimises impacts from increasing fuel costs	
	Railway precinct becomes main commercial hub	Enhances town character and underutilised historic streets	Increases community cohesion and local identify	
Water Bank	Combined distributed energy and water system	Reliance on external energy and water supplies	Links energy and water supplies to locally-based sources	
	Co-management of infrastructure	Reliance on external management priorities	Increases community control of critical services	
	Utilisation of multiple water sources	Water security at risk from droughts	Diversifies water supply	
	Storage of water on hill-tops along with micro-turbines for energy generation	Blackouts put water supply at risk	Diversifies energy service provision	
			Enables gravity-fed water supply	
	Water supplies tailored to water demand	Water security at risk from droughts	Increases water use efficiency	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Timber Manufactory	Light commercial area involving multiple small-scale advanced wood processing and manufacturing industries	Once vibrant forestry industry has substantially declined. Remains are at risk from changing climate and global market conditions	Diversifies local economy	
			Supports part of Creswick's historical identify and builds economic independence	
	Energy from Forestry waste	Energy security at risk from heatwaves and storms	Diversifies energy supplies	
	Hub positioned adjacent to Railway	Commercial freight services dependent on road transport	Diversifies freight options	
			Minimises impacts from increasing fuel costs	
Agri-Hub	A platform for teaching and knowledge exchange around food production and processing	Declining food production and processing skills	Strengthens and retains existing community strengths in farming and horticulture	
	Community-owned share facilities for food processing	Food supply dependent on external sources and road freight	Supports local economy and skill development	
		Limited local production	Builds common assets and identity	
	Hosts produce exchange and small-scale wholesale market	Declining viability for local farmers – linked to lack of market diversity	Diversifies local economy	
	Incorporates adjacent food production areas (along creek floodway)	Food supply dependent on external sources and road freight	Increases local control of and access to food supply	
			Improves access to fresh produce	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Resilience Zone	Trans-council administrative area for co-management of resilience	No formal capacity to share responsibility for	Creates a formal resilience-focused institution at an appropriate scale to risks	
	Entry-toll to Great Ocean Road targeting non-permanent residents	Limited resources for addressing climate risks	Builds financial resources to address shared vulnerabilities	
	Funds support local projects that build resilience		Strengthens	
	Zone Mobile App provides tourists and residents with updates on location specific risks and ability to feedback information	Large tourist population with limited knowledge or access to information on possible risks	Enhances entrants capacity to identify and respond to risks	
		Large area to monitor	Enhances zone agency to identify and respond to risks	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Lake Precinct and relocation	Coal mine left to fill with water – becoming a lake	Anglesea vulnerable to drought and largely reliant on mains reticulated water	Diversifies water supply	   
			Localises water supply	
	Development allowed on suitable disturbed mine areas (around lake)	Limited area for relocation of low-lying town	Provides flexibility for future land use decisions without affecting town character or natural habitat	
	Gradual re-location of at-risk residents and businesses to Lake area	Low-lying area of town at risk from future sea-level rise and flash flooding	Eliminates flood-risk for residents	
	Gradual refocus of town from coast to lake	Town's cultural connection to coast and river potentially threatened by coastal erosion and flooding	Minimises cultural shock from coastal erosion and allows town to subtly change identify while keeping emphasis on water culture and natural environment	
	Use of lake as heat-sink for centralised cooling system to supply key community buildings	Heatwaves threaten young and elderly – particularly during blackouts	Provides alternative source of cooling and reduces reliance on external power grid (at risk from bushfires)	
	Energy park situated near lake	Electricity supply depends on external sources and at risk from bushfires	Diversifies energy sources and localises production	
	(comprising solar, wind and geothermal generators)	Water supply to parts of town at risk from blackouts	Provides alternative and back-up energy supplies less vulnerable to fires	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Emergency & Public rapid transit network	Parallel inland road route from Torquay to Moggs Creek exclusively for emergency and public transport vehicles	Emergency vehicle access blocked by traffic jams at Anglesea	Provides alternate entry and exit routes	    
		GOR at risk of coastal erosion or flooding at Anglesea river	Allows for extended maintenance times	
		Maintenance of GOR likely to increase due to increased impacts	Allows for longer maintenance times	
		GOR users at risk from bushfires	Allows better monitoring of tourists on the GOR	
	Transport nodes connect electric busses to smaller low-impact vehicles such as bikes and scooters	Tourist access along GOR vulnerable to fuel price fluctuations	Diversifies transport mode options	
		Car accidents on GOR are frequent and threaten access.	Reduces large vehicle traffic within towns	
			Reduces chance of accidents along GOR	
Market Garden network and food hospitality	Hospitality training centre specialising in local and native foods	There are limited local employment opportunities in Anglesea and the town is overly reliant on tourism for income	Diversifies local economy	 
		Residents currently need to move away or travel distances to access training opportunities	Provides training opportunities locally	
	Connected to network of community gardens situated throughout Anglesea	Extreme weather events can put strain on food supply	Diversifies food supply	
			Increases food production skills	
			Brings individuals and groups together to share knowledge and skills	
	Festival celebrates regional food strengths		Strengthens regions strengths and builds social connections	

Vision	Core elements and functions	Vulnerability or need addressed	How it improves resilience	Principles
Institute for Eco-tourism and environmental education	Small precinct housing Deakin university satellite campus teaching Eco-Tourism and environmental education masters and short-courses	There are limited local employment opportunities in Anglesea and the town is overly reliant on tourism for income	Diversifies local economy	  
			Provides training opportunities locally	
	Precinct designed as oasis for heatwaves offering public facilities	There are few places of respite during heatwaves	Provides a location for social interaction to continue during extreme conditions	
	Precinct air conditioned by lake water-source cooling system	Air conditioning puts a serious strain on the electricity grid, resulting in blackouts	Reduces the strain on the main electricity grid	
	Students live-in the community, billeted with residents in vacant homes	Anglesea's strong culture of volunteerism is at risk from an ageing population, younger resident families spending more time out of town (commuting to work) and the high proportion of temporary residents.	Provides opportunities for knowledge sharing	
			Strengthens social connections	
	Building is exemplar of ecologically sensitive design		Reduces the strain on the main electricity grid	

"At every level the greatest obstacle to transforming the world is that we lack the clarity and imagination to conceive that it could be different."

Roberto Unger

Victorian Eco Innovation Lab (VEIL)

Faculty of Architecture Building and Planning
Melbourne School of Design
Building 133
University of Melbourne
Victoria, Australia, 3010

www.ecoinnovationlab.com

VEIL | victorian eco innovation lab

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